PB-227 708

HOSPITAL SOLID WASTE

AN ANNOTATED BIBLIOGRAPHY

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MARCH 1974

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1. REPORT NO. EPA-670/5-74-001	2.	PB 227 708
4. TITLE AND SUBTITLE Hospital Solid Waste: An Annotated Bibliography		5. REPORT DATE March 1974
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Rexford D. Singer, Alain G. DuChene, Nichole J. Vick		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS University of Minnesota School of Public Health Minneapolis, MN 55455		10. PROGRAM ELEMENT NO. 1DA312
		11. ~~CONTRACT~~/GRANT NO. EP-00458-02S1
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency National Environmental Research Center Solid and Hazardous Waste Research Laboratory Cincinnati, Ohio 45268		13. TYPE OF REPORT AND PERIOD COVERED Final
		14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

The literature abstracted includes both foreign and domestic published mainly during the ten years prior to 1973. Abstracts are arranged in four sections: (1) generation of hospital solid waste, (2) collection and transport, (3) treatment and disposal, and (4) management in general. Author and subject indices are included. The 485 abstracts are not exhaustive but are intended to be representative of the available literature.

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INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
	Hospital Solid Wastes Management of Solid Wastes Annotated Bibliography	

18. DISTRIBUTION STATEMENT Unlimited release	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 205
	20. SECURITY CLASS *(This page)*	22. PRICE 5.75/1.45

EPA Form 2220-1 (9-73)

EPA-670/5-74-001
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An Annotated Bibliography

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Research Grant No. EP-00458-02S1
Program Element No. 1D1312

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REVIEW NOTICE

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FOREWORD

Man and his environment must be protected from the adverse effects of pesticides, radiation, noise and other forms of pollution, and the unwise management of solid waste. Efforts to protect the environment require a focus that recognizes the interplay between the components of our physical environment--air, water, and land. The National Environmental Research Centers provide this multidisciplinary focus through programs engaged in

- studies on the effects of environmental contaminants on man and the biosphere, and
- a search for ways to prevent contamination and to recycle valuable resources.

The research grant study reported herein is part of the continuing effort to find new ways for improving the management of solid waste and thus enhancing environmental quality. Managers of hospitals and other medical care facilities are confronted with special problems in the handling and disposal of solid wastes. Extraordinary precautious are required to protect not only the patients for whom services are provided but also the working staff and the public at large. This annotated bibliography will be informative and useful to all those who are charged with this responsibility.

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ACKNOWLEDGEMENTS

The authors wish to express their appreciation to the following named individuals for their assistance and contributions of valuable information: Edward J. Bertz, Director, Division of Plant Operations, American Hospital Association; Albert F. Iglar, Ph.D., Assistant Professor, Department of Environmental Health, East Tennessee State University; Vinson R. Oviatt, Chief, Environmental Services Branch, Division of Research Services, National Institutes of Health; Lynn P. Wallace, Ph.D., Chief, Ultimate Disposal Branch, Division of Research and Development, Solid Waste Management Office, Environmental Protection Agency; and, Thomas A. Whalen, Staff Engineer, Division of Technical Operations, Bureau of Solid Waste Management, Environmental Protection Agency.

The authors also wish to acknowledge the continued interest and encouragement of Richard G. Bond, Professor and former Director of the Division of Environmental Health and the assistance provided by other members of the staff. We would also like to express our gratitude for the guidance and financial assistance provided by the Project Officer, Oscar W. Albrecht, and the Environmental Protection Agency.

The authors are indebted to the publishers of the several abstract publications who generously permitted us to quote their abstracts. Their contribution allowed us to concentrate our efforts on literature not previously abstracted which has resulted in a comprehensive bibliography.

PREFACE

The literature abstracted in this bibliography covers the period prior to 1973, concentrating mainly on literature, both foreign and domestic, published in the last ten years. However, two reports published in 1973 have also been included (abstract nos. 4-003 and 4-011) because of their significant contribution to the field of hospital solid waste management. Although the bibliography is not exhaustive, the 485 abstracts do constitute an extensive search and are believed to be representative of the available literature.

The abstracts are arranged into four sections: generation of hospital solid waste, collection and transport, treatment and disposal, and management in general. A general description of each section is given in the table of contents. Each abstract was placed into one of the four sections based on the authors' decision as to the major topic of concern in the literature. The abstracts are arranged alphabetically within each section, and information pertaining to the source of quoted abstracts is provided in brackets at the end of the bibliographical citation.

Author and subject indexes are included. The subject index is made up of 48 keywords, each of which is broken down into secondary keywords. Abstracts were keyworded using one or more of the keywords and all keywords were considered of equal weight.

The authors are not able to furnish reprints of the cited publications, with the exception of certain reports authored by members of the Division of Environmental Health, School of Public

Health, University of Minnesota. If copies of publications cannot be located in local libraries, readers should contact the original author(s) or publisher to obtain reprints. A list of cited periodical publications is included for this purpose.

Mention of specific company names and products in this annotated bibliography is intended to illustrate some of the methods employed in hospital solid waste handling, and does not constitute endorsement by the University of Minnesota or the Environmental Protection Agency. Many other equally effective products are now available to assist hospitals with their solid waste handling problems.

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SECTION I. GENERATION OF HOSPITAL SOLID WASTE

1-001

Arnold, F.D. Hospital wastes--handle with care. Executive Housekeeper, 18:56+, Apr. 1971.

Pathological, contaminated, infectious, hazardous, biological, radiological, chemical, administrative, isolation, and food wastes need definition and a written plan for effective management and handling within the hospital. The author includes statements from several relevant publications and concludes that "improving the containerization of wastes will reduce hazards to patients and personnel."

1-002

Barlow, P.J. Hospital waste disposal. Environmental Health (London), 80(3):74-76+, Mar. 1972. [845, Hospital Abstracts, 12(6), 1972]

Patients in hospital, being mainly either ill, very young or very old are especially susceptible to infections. Investigations have shown that disease agents in waste can remain active for long periods, so that immediate removal of waste is very important. Hospital waste includes: (i) patients' personal refuse, such as sweet papers, apple cores, paper tissues; (ii) swabs and dressings; (iii) food scraps; (iv) disposable equipment; (v) pathological waste; and (vi) operating theatre waste. Food scraps should never be returned to the kitchen but can be disposed of by a sink grinder in the ward kitchenette. Small plastic buckets with lids can be used in the kitchen for waste going for pig swill, the swill being then stored away from the kitchen. Incineration at ward level or central destruction can be used for disposables but some of the newer materials now being used are soluble in water. Infected waste should be put into plastic bags and destroyed by incineration. In hospital waste removal is usually done twice a day. Coloured paper sacks are necessary when refuse is disposed of in different ways. Refuse left for any length of time attracts insects and rodents; proper control of these is essential. The method used for transporting waste must ensure that refuse from one area does not contaminate another. Recommendations on the planning of a hospital waste disposal system are summarized.

1-003

Bond, R.G., and G.S. Michaelsen. Bacterial Contamination from Hospital Solid Wastes. Final Report. Minneapolis, University Health Service and School of Public Health, University of Minnesota, 1964. 164 p. [HU2001, Abstracts of Hospital Management Studies, Vol. II, 1966].

A four-year study and analysis of solid wastes handling procedures and their effect on the microbial quality of the hospital environment. University Hospital at the University of Minnesota and Lutheran Deaconess Hospital in Minneapolis were subjected to the survey. A survey of fifteen service areas produced various categories of solid waste such as soiled laundry, reusable instruments, kitchen wastes, etc. Waste handling activities were simulated and subjected to air sampling and the use of tracer organisms to determine contamination. Recommendations for reducing contamination include laundry handling and floor cleaning methods. A list of 64 references related to this subject are included.

1-004
Brewer, J.B. New thinking on infectious waste. Executive Housekeeper, 19(6):82+, July 1972.

Hospitals in the Los Angeles area became increasingly aware that there was "no method by which hospitals could dispose of infectious solid waste without violating the regulations of some public agency". Incinerators were shut down due to air pollution caused by the burning of disposable plastics. Infectious wastes could not be hauled through the streets, or disposed of at landfills or through the sewer system. Before solutions could be sought, the Hospital Council of Southern California felt an exact definition or parameters of what constitutes infectious waste were needed. Because of the difficulty of separating infectious waste from other waste, infectious waste was defined by areas in hospitals in which such waste would be generated. These areas included the laboratory, surgical operating rooms, isolation rooms, as well as disposable materials from emergency rooms and outpatient areas. A study of Los Angeles area hospitals showed that of an average total of 10.25 lbs. of waste per patient per day, only .38 lbs. was infectious waste. Only 7 per cent of the infectious waste was tissue material while the majority was paper, plastic, cloth and glass. Because of this information, regulations were revised to permit grinding of infectious waste (excluding human tissue) into the sewage system.

1-005
Burchinal, J.C. A Study of Institutional Solid Wastes; Interim Report. Morgantown, West Virginia University, 1968. 15 p. [68-0187, Solid Waste Management, 1968].

The specific aims of the study are: to determine the physical and chemical composition of the solid wastes from one medical school and hospital complex; to determine whether bacteria and viruses are present to any significant degree; to provide a classification basis and obtain quantity values for the wastes of various departments; to establish a safe procedure for studies on potential pathogenic wastes; to provide information about solid wastes that can be used by designers of medical complexes; and to develop a sampling procedure which could be used in future studies. Various methods of solid wastes disposal and volume reduction are utilized within the Center. These include incineration, burial, selling, and discharge to the sanitary sewer. Radioactive wastes are disposed of by periodic burial. The design of sampling and weighing procedures to obtain weights, estimated volumes, types, and generation origins of solid wastes within the entire center is outlined. The total cost of refuse handling and disposal comes to $77,280 per year and using a rough approximation of 1,000 tons of refuse generated per year this gives a cost of $77.28 per ton. Solid wastes generated by the different portions of the hospital for given dates are tabulated. Sampling data is placed on format sheets for card punching so that the computer may be used to analyze the data.

1-006
Galli, A.A. Chemical Analysis of Solid Wastes from a Teaching Hospital. Problem Report. University of West Virginia, Morgantown, W.Va., 1971. 114 p. [Abstracts, Excerpts and Reviews, Vol. V, 1972].

Disposal of wastes from the West Virginia University Medical Center involves three methods, namely, incineration, burial in a sanitary landfill, and salvaging and grinding for disposal into sanitary sewers. Food wastes are disposed of via the sewer. In the hospital section, a refuse chute, which terminates in the general purpose incinerator room is used to service all floors. The sample collection system consisted of dividing the wards and sections of the hospital and basic sciences building into areas that were easy to control and which contributed comparable amounts of refuse. Refuse generated at each sampling station was collected for a 24-hr period for each day of the week. Refuse at each station was collected by a worker and was placed in a 30-gal container lined with polyethylene. Each day the bagged refuse was transported to the Engineering Sciences Building (distance 1.7 miles). The physical analysis consisted of eleven different unit operations beginning at the storage area and ending with the analyses. Statistical techniques were used to analyze the data. The frequency distribution diagrams indicated that most percentages of chemical constituents varied within a small range. Consequently a design engineer could base design parameters on about any section of the institution, but he should make a test of those areas the wastes of which showed greatest variability, namely the ground floor, emergency room, offices, X-ray room on the second floor, and the intensive care unit and operating room on the third floor of the hospital. Greatest variability in the Basic Sciences Building occurred in wastes from the animal quarters, bookstore, and restrooms on the ground floor; library and offices on the second floor, and offices on the third floor. The Btu, volatile solids, and ash tests can best be used for design parameters. The Btu value of wastes from the hospital and the Basic Sciences Building averaged about 8,000 Btu/lb. Therefore, to ensure the temperature required for complete combustion, an auxiliary fuel system must be provided.

1-007
Hanks, T.G. Solid Waste/Disease Relationships. Publication No. 999-UIH-6. Cincinnati, National Center for Urban and Industrial Health, Public Health Service, 1967. 179 p. [13025, SWIRS].

Solid wastes have been demonstrated conclusively to be associated with some diseases in the United States. Many wastes contain or provide breeding grounds for disease agents which can be spread to humans through biological vectors or by direct contact with the waste. A preliminary section is devoted to methodology, definitions, and conclusions, after which is presented several aspects of the solid waste/disease relationship. These aspects are: pathways; disease associated with chemical wastes; communicable disease; injuries and safety considerations; and disaster. Following these sections a reference list is cited, followed by tables, figures, and three appendices. The general conclusion is that research thus far fails to supply data which would permit a quantitative estimate of any solid waste/disease relationship. The circumstantial and epidemiologic information presented does support a conclusion that, to some diseases, solid wastes bear a definite, if not well defined, etiologic relationship. The diseases most incriminated are those whose agents are found in fecal wastes, particularly human wastes. Evidence concerning flies as carriers of disease is more pronounced than that on mosquitoes or rodents. In general, recommendations call for increased detail in researching and more sophisticated and sanitary methods of waste disposal.

1-008
Hospital Design Features Affecting Maintenance of Asepsis. Public Health Service Publication. Washington, U.S. Government Printing Office, Feb. 1960. 17 p.

A cleanup room should be located near the operating rooms for wastes and items to be cleaned. This and similar rooms should have negative air pressure to prevent exfiltration of air. Locations for "sanitary waste receptacles" were suggested and also locations for waste paper receptacles. Refuse chutes were not recommended for hospitals, since they were considered unsanitary.

1-009
Hospital solid wastes and their handling. American Journal of Public Health, 46:357-367, Mar. 1956. [3669, SWIRS].

A Hospital Facilities Committee, formed in 1952, selected as its first undertaking a survey and study of hospital solid wastes. A major objective of the report was to study the total production and relative amounts of the several components of hospital wastes. Aside from common rubbish, garbage, and wastes, various biological wastes are produced in patient care activities and in surgery. One-week surveys returned from 29 hospitals reported the amounts of wastes collected as garbage, combustibles, noncombustibles, and surgical and autopsy wastes. Specific weights, unit weights, and volumes were calculated. Hospitals with 125-250 patients have 7- 8 1/2 lbs. of waste daily per patient. Storage and collection systems must be frequent yet economical, must present minimum opportunities for contamination, and must be compatible with other hospital routines. Containers for waste collection ranged from bed pans, sponge receptacles, and kick buckets to large galvanized iron cans. Storage and transfer containers included canvas hampers, metal drums, and steel bins. Eighty percent of the hospitals hauled their own combustible wastes to points of ultimate disposal. Disposal methods varied with waste categories as did container types. Hog feeding ranked high in garbage disposal, while sanitary landfills were used for noncombustibles. Surgical and autopsy wastes were incinerated when possible. Recommended sanitary precautions included protective clothing for personnel handling wastes, and regular cleaning of containers.

1-010
Iglar, A.F. Hospital Solid Waste Management: An Empirical Study With Particular Regard to Quantities of Solid Waste. Ph.D. Thesis. University of Minnesota, Minneapolis, Minn., 1970. 344 p. [HU2-7417, Abstracts of Hospital Management Studies, Vol. VIII, 1972]

Study investigates hospital solid waste management: types, sources, quantities, and methods of collection, treatment and disposal of solid waste generated at hospitals. Data were collected from interviews and observations at several nongovernmental, nonprofit, general hospitals with 50 or more beds. A number of factors which were found to be significantly related to quantity of solid waste generated are discussed, as are implications of these findings for the design and operations of solid waste handling in hospitals.

1-011
Lane,T.M. Trends in the use of disposables in health care facilities. In Salkowski, M.D., ed. Disposal of Single-Use Items from Health Care Facilities; Report of the Second National Conference, September 23 and 24, 1970. Monograph No. 8. Ann Arbor, National Sanitation Foundation, Sept. 1970. p. 10-16. [15532, SWIRS].

The Disposables Association now has a membership of 172 textile, paper, chemical, and plastics companies, machinery manufacturers and fabricators, distributors and educators from 17 countries. Recognized by this trade association as today's greatest challenge is the disposability of disposables. But before proposing solutions to the solid waste problem facing hospitals, the association reviewed the current trends in the marketing of medical single-use items. The general hospital is the largest single sector of the health care market for disposables. Typical limited-use health care products are presterilized bed pads, sheets, pillowcases, blanket covers, examination gowns, diapers, washcloths, alcohol preps, shoe covers, water carafes, dishes and drinking cups, oxygen canopies, transfusion tubings and fittings, thermometers, and hypodermic syringes and needles. These disposables are combinations of materials such as paper, plastic, rayon and acrylic, cellulose and nylon, glass and metal. The main reasons for the adoption of disposables are economic pressure and freedom from possible contaminating or infectious agents. Health care products are thus evaluated on the basis of their contribution to patient safety and comfort. So expenditures have risen from a mere $30 million in 1966 to over $126 million now. It seems, then that the future of hospital disposables is synonymous with the direction of health care in general. But proper disposable techniques are needed, and the Disposables Association plans to continue assisting in measures to guarantee the disposability of disposables.

1-012
Laundering increases at the rate of five per cent each year: waste materials increase more in volume than in weight. Sjukhuset (Goteborg),44(7):207-210, Aug. 1967. [1396, Hospital Abstracts, 8(9), 1968].

The weight of dirty linen for laundering increases by four to five per cent per year: the most rational way of disposing of dirty linen is down a stainless steel shaft fitted with a terminal braking curve and an anti-back-suction system or sprinkler. The density of hospital rubbish fell from 150 kg. per cu.m. in 1960 to 75 kg. per cu.m. in 1966 and is expected eventually to fall to 45 kg. per cu.m. The total volume has meanwhile risen from about 100 to 180 cu.dm. per bed per week and is expected to be over 500 by 1960. Waste reaches the waste disposal room via its own shafts in its paper or polythene bags. The bags either enter a crusher/compressor or are burnt Two Swedish hospitals have installed vacuum transport systems for waste disposal: it is possible for such systems to carry waste to a destructor (e.g. a district central heating boiler-house) up to a mile away. Kitchen waste is frequently fine-ground and washed away in an automatic disposal unit: disposable sputum cups, etc., may be dealt with similarly. Manual handling of laundry or waste must be kept to a minimum on financial as well as hygienic grounds.

1-013
LeTourneau, C.U. Nosocomial infections - part II. Hospital Management, 83(3):52-53+, Mar. 1957.

Important sources of nosocomial infections are: dressings containing pus from wounds; bacteria in droplets; infected excretory matter; discarded casts and bandages; cast cutters and bandage scissors; as well as bath and shower mats.

1-014
Marett, D.L., and O.M. Riley. Nursing refuse disposal inquiry. Nursing Times (London), 67(29):113-116, July 22, 1971. [HU2-7637, Abstracts of Hospital Management Studies, Vol. VIII, 1972].

The purpose of this study was to determine the quantity of refuse material disposed of by health visiting, nursing and medical staff in the North Bucks, England area and to discover how and by whom this material is destroyed. Refuse material was divided into four categories and data on the quantity and method of disposal for each were gathered from November 1-30, 1970. Results are presented.

1-015
Medics face giant problem in refuse handling. Solid Wastes Management - Refuse Removal Journal, 14(13):16+, Mar. 1971. [13671, SWIRS].

Hospitals everywhere are having difficulty disposing of the 7.05 lb of solid waste products that are generated by each patient each day. This large amount comes mainly from the new disposables or single-use items that have been developed for institution care. After use, these items fall into one of two main categories: the general type of trash; and contaminated refuse. These two types must be kept separate from one another, which complicates even more the collection, storage, and disposal of the waste. Hospitals are finding a big help in the new plastic trash bags; they are also experimenting with grinders, which shred and compact the refuse for hauling to a dump or for washing into the sewage system. Still, furnaces need to be improved for more efficient and pollution-free disposal and hospitals need better layout planning for a central waste disposal unit.

1-016
Mueller, E. Patients like disposables, Elmhurst study finds. Modern Hospital, 112(6):97-99, June 1969. [99[illegible]8, SWIRS].

A recent 34 day trial of paper trayware at Elmhurst (N.Y.) Hospital convinced officials of the institution that use of disposables for all patients has definite advantages, not the least of which are financial. When the choice was made and a definite figure for the number of paper items was determined, a 5 percent overage allowance was added to provide for waste and for damage in handling. Advance planning with the housekeeping and engineering departments helped minimize problems. Housekeeping was informed that there would be extra waste and that extra cans and bags were needed. Engineering was also informed that there would be extra waste to be burned. The extra waste averaged two 30 gallon bags/meal for 180 patients. The mixed paperware and garbage weighed only about 15 lb/bag. When the bags were filled, they were simply tied and placed on top of cans going to the disposal area from other locations. Burning of the paper wastes required only 30 to 40 minutes.

1-017
New definition of "Infectious" may solve disposal problems. Modern Hospital, 116(2):34-35, Feb. 1971.

At a mid-January hearing, the Los Angeles Air Pollution Control District agreed to give hospitals nine months to conduct an experiment to determine whether a new definition of "infectious" allows safe segregation of wastes and facilitates disposal. Under the new definition, waste from surgery, pathology labs, isolation rooms, and emergency rooms will be considered "infectious" and handled separately. In addition, only those syringes used in treating patients with communicable diseases will be considered "infectious". All other waste is considered noninfectious and can be trucked to landfills.

1-018
Oviatt, V.R. Storage and transportation affect contamination problem. Hospital Purchasing, 15:2, May 1971.

The author recommends that "solid waste items should be packaged at their source" to keep aerosols from being generated during handling. Space manpower requirements must be considered in designing waste handling systems. State and federal legislation concerning the transportation of hazardous material from the hospital to the disposal area must be considered.

1-019
Reybrouck, G. and H. van de Voorde. Hospital refuse, its qualitative and quantitative composition. Hospitalia (Brussels), 14(2):80-91, 1970. [1824, Hospital Abstracts, 10(12), 1970].

The composition of hospital waste matter is considered from the point of view of its production, not of its removal. In university hospitals the quantity of waste produced now amounts to 14.3 litres per bed per day with a specific weight of 0.16 kg/litre. In non-university hospitals the amount is less, but varies considerably, being from 0.91 litres to 6.13 litres per patient per day. This amount appears likely to increase due chiefly to the growing use of non-returnable containers and disposables. Increase in volume is likely to exceed increase in weight. Eight tables give the following: the nature of hospital waste, according to hospital departments; the quantity of waste produced by a university hospital, analysed according to departments; the quantity of waste produced by 30 non-university hospitals, analysed according to type of waste; the quantity of waste produced by 20 non-university hospitals, in terms of amounts produced per patient per day and per month; the quantity of kitchen waste produced in 26 non-university hospitals; the quantity of plaster waste produced per day and per week in 26 non-university surgical units; and the total hospital refuse per patient per day in terms of kilograms or litres in Great Britain, Sweden, France, Germany and the United States.

1-020
Small, W.E. Solid waste: please burn, chop, compact or otherwise destroy this problem. Modern Hospital, 117:100-110, Sept. 1971.

The author reviews the results of recent hospital solid wastes studies and discusses factors of cost, labor, storage, convenience, infection control, patient safety, and environmental pollution. The elements of solid waste management which are discussed should determine hospital use of disposables and the choice of storage, transport, processing and disposal. All variables should be considered in regard to the impact of the choice upon the hospital economics, efficiency, and the environment. Thus needs are based on a total systems concept.

1-021
Snow, D.L., et al. Hospital solid wastes and their handling. American Journal of Public Health, 46(3):357-367, Mar. 1956.

Solid waste handling should be considered in the earliest stages of hospital design. Combustible waste per patient increases with increasing hospital size, while garbage and noncombustible wastes decrease. Average refuse production is 6-1/2 to 9 lb. per patient per day, the lower figure being for larger hospitals. Recommendations include the use of disposable can liners, routine cleaning of all waste containers, mechanization of container washing, minimizing waste transfer, and cooking any garbage fed to hogs.

1-022
Straub, C.P. Low-Level Radioactive Wastes; Treatment, Handling Disposal. Washington, U.S. Atomic Energy Commission, 1964. 430 p. [64-0758, Solid Waste Management, 1964].

Techniques of handling, treatment, and disposal of low-level wastes which arise in all nuclear energy operations are described. Guides to radiation-exposure assessment are given. Topics covered are: sources, quantities, and composition of radioactive wastes; collection, sampling, and measuremnt of gaseous, and solid wastes; discharge to the water, soil, and air environments; removal of radioactivity by water treatment processes; treatment of radioactive material by biological processes; on-site treatment; handling and treatment of solid wastes; and public health implications. Standards for protection against radiation and site selection criteria are appended. Specific examples of packaging and treatment of wastes and their disposal on land an in the ocean are described in some detail.

1-023
Taylor, J. Caution on unit compactors. Hospital Engineering Newsletter, 17(4):6, July-Aug. 1972.

In this letter to the editor, the author describes tests performed at a Detroit hospital to determine if there is a possibility of organisms being diseminated into the air by the use of small compactors in the hospital. Culture plates were placed at various distances from the machine which was operated with wastes normally associated with patients in the area. "The results were four to five times higher than we consider normal for the same room under usualy conditions." The unit was shut down pending further study.

1-024
Taylor, R.C. How one hospital disposes of garbage. Hospital Management, 71(1):120-122, Jan. 1951.

The Colorado State Hospital trucked its five to nine tons per day of garbage to its hog farm. In two years, production had totaled 379,608 lb. of dressed pork and 85,037 lb. of lard worth $148,173. Total cost of production was $46,309. The slaughtering was done at a commercial packing house under government inspection, and the fresh pork was used by the hospital. Refuse which could not be sent to the hog farm was disposed of at a dump on hospital land.

1-025
Top, F.H., ed. Control of Infectious Diseases in General Hospitals. New York, American Public Health Association, 1967. 82 p.

Although disposable dishes and tableware meet sanitary standards, they are reported to meet unfavorable reactions from patients. Even for isolation, disposables should be used only when necessary, such as during a shortage of properly trained kitchen help. The author includes collection and disposal suggestions for general waste, biological and pathological waste, and some disposable items. Because laundry/refuse chutes produce a piston effect that can force bacteria-laden air horizontally into nursing stations and other areas of the hospitals, some communities have prohibited use of such chutes in hospitals. Bacterial contamination can be controlled by use of disposables.

1-026
Wallace, L.P. Solid Waste Generation by the Units of a Teaching Hospital. Ph.D. Thesis. West Virginia University, Morgantown, W. Va., 1970. 99 p. [5499, SWIRS].

The lack of information on refuse production from each unit of a hospital prompted this investigation. The amounts and kinds of wastes produced by each unit are necessary data for designing effective and economical waste disposal means. A review of the literature provides background for the study. Experimental methods are explained. Prediction of the quantity of waste from each unit were possible when based on the number of 24 hr staff on duty, but not when predicated on the total unit population or number of bed patients. Equations for prediction are provided. Recommendations for improved waste management are listed. Data tables and a sample computer program are included in the appendices.

1-027
Wallace, L.P., R. Zaltzman, and J.C. Burchinal. Where solid waste comes from; where it should go. Modern Hospital, 118(2):92-95, Feb. 1972. [241, Hospital Abstracts, 13(2), 1973].

A study of solid waste was undertaken by West Virginia University to: (1) determine the physical and chemical composition of the solid wastes from a hospital and medical school; (ii) establish whether bacteria and viruses are present in significant quantities; (iii) develop a classification; (iv) establish safety procedures; (v) provide information for designers; and (vi) develop a sampling procedure. The study was conducted over a three-year period on an average daily population of 4,170 and at week-ends of 1,103. Two main categories of waste were considered: (i) disposable wastes, including unwanted materials; and (ii) reusable wastes. About 14,800 pounds of solid waste were handled each day (4,700 for disposal and 10,140 processed for reuse). Incineration reduces the gross volume to 33 per cent by incineration and to 15 per cent through compaction. If the centre were to convert totally to disposables the capacity of the waste management system would need to be doubled. Simple mathematical equations were developed which related the expected average waste generation to the type of hospital unit. Waste generation rates should be based on common parameters. Of the total waste only 25 to 30 per cent could be considered infectious or potentially dangerous. More than 60 per cent by weight of the total wastes came from support services.

1-028
Walter, C.W. Environmental sepsis. Modern Hospital, 91(6):69-78, Dec. 1958.

Bacteria can multiply in both wet and dry dressings. Trash, dressings, and other refuse should be separated from soiled laundry to eliminate sorting before washing, a process which can transfer organisms into the air. The piston action of waste chutes also can spread pathogens.

1-029
Wilkinson, T.K., R.P. Morrison, and V.R. Oviatt. Control of physical and chemical agents. Hospitals, 46(20):95-97+, Oct. 16, 1972.

The prevention and control of safety and health hazards generated by physical and chemical agents in the hospital complement infection control as measures to make the hospital a safe working environment for employees. Such environmental control programs require (1) the recognition of those agents presenting potential or actual hazards and (2) evaluation of the degree of risk. Physical agents include thermal stress, noise, vibration, magnetic fields, ionizing radiation, and nonionizing radiation. The authors discuss ionizing and nonionizing radiation, heat, and noise in relation to the hospital environment. Chemical agents include flammable and toxic chemicals (hydrochloric acid, chlorinated hydrocarbons, anesthetics, and mercury) used in research, service, and patient care areas in the hospital. An effective environmental control program depends on a meaningful fiscal and manpower commitment by the hospital's administration, as well as a willingness "to devote the requisite time and concern to the formulation of the policies necessary for the implementation of a balanced preventive program". Ideally, the hospital would employ an environmentalist specifically trained to recognize and correct these hazards which usually can be remedied by improving the plant and/or equipment or by adjusting procedures, methods, or techniques. Problems of extramural origin will necessitate coordinating in-hospital efforts with the community at large.

1-030
Williams, R.E.O., et al. Hospital Infection: Causes and Prevention. Chicago, Year Book Medical Publishers, Inc., 1960. 307 p.

Although disposal methods rarely can be evaluated in terms of their contribution to infection control, two good general disposal principles are to immediately place the contaminated articles into special containers which should be disposed of in the same way as their contents, thereby eliminating transfer and a trail of contaminated containers. Refuse chutes, designed for easy cleaning and exclusion of contaminated air from wards, should not be used for "grossly contaminated articles". Dressings should be handled with gloves or forceps, dropped directly into a paper bag, then delivered to the hospital or ward incinerator. All sputum should be handled as carefully as if containing tubercle bacillus. Waxed cardboard containers are preferred for bedside collection.

SECTION II. COLLECTION AND TRANSPORT

2-001
The Amsterdam public cleansing service experiments with special containers for hospital waste. Technische Gids voor Ziekenhuis en Instelling (Amsterdam), 35(843):573-575+, June 1966. [338, Hospital Abstracts, 7(2), 1967].

Scarcity of labour and increase of waste led the Amsterdam public cleansing service to experiment with large containers for refuse collection from hospitals instead of the usual bins. Emptying is mechanized and served by one man. Bins are emptied into the containers by the hospital staff. The capacity of the four-wheeled containers is 100, 500 and 750 litres. The system is satisfactory for the cleansing service but hospital opinion is divided. Some hospitals have adapted their internal disposal methods to the new system in various ways (such as using plastic bins instead of the old metal ones; using disposable bags; having special platforms where bins are tipped into the containers; and by taking the containers to the departments for collection). Complaints are that labour saved by the cleansing department is now carried out by the hospital staff; that infectious materials and ordinary refuse are not properly separated; that the large containers are difficult to clean, are too high, and difficult to keep closed; and that the costs of renting the containers and paying for the collections are too high.

2-002
Anderson, J.R. Service from headquarters: disposal of purulent material. Hospitals, 33:25, July 1959.

The New York State Department of Health manual on Control of Staphylococcal Infections in Hospitals recommended that all contaminated, disposable material be placed in water-tight bags and wrapped in clear paper. They can be placed at the door of the patient's room for collection and transportation to the incinerator.

2-003
Armstrong, D.H. Hospital Refuse-Chute Sanitation. M.S. Thesis. West Virginia University, Morgantown, W.Va., 1969. 36 p. [8190, SWIRS].

The sanitation of a hospital refuse chute was evaluated with respect to airborne bacteria. An attempt was made to measure the dispersal of viable airborne bacteria from the handling of refuse in the chute closet area and to evaluate the effect of wrapping the refuse in bags. It was concluded that placing the refuse in bags reduces the total number of airborne bacteria generated. The smaller particle sizes which can penetrate the respiratory tract were not removed as easily as the larger particles. From velometer studies of airflows it was concluded that the possibility exists for viable organisms to be transmitted to other parts of the hospital by way of the refuse chute. There was a hazard presented by the backing up of refuse in the chute, packing refuse against the chute doors. The following recommendations were made: use plastic bags for all refuse thrown into the chute; do not deposit any wastes into the chute which may be seriously contaminated; create a negative pressure on the chute to prevent air from escaping from the chute onto the floors by the use of ducts or vents; and remove the vent to the hallway near the incinerator room so that there will be less mixing of air between these two areas. Future studies in this area should include the identification of organisms present in hospital refuse and an analysis of the dispersion and distance of travel through the hospital.

2-004
Automatic removal of laundry and waste: first hospital to have each floor served. Hospital Engineer (London), 18(12):358, Dec. 1964.

The new 500 bed hospital at Sidcup, England, was designed with a special elevator for the automatic removal of laundry and waste from each floor. The elevator consists of an endless "ladder" of slings designed to receive laundry or waste in polyethylene bags of up to 60 pounds. Each bag is deposited on the ground floor in a wheeled laundry or waste container as specified. The slings are easily removed for cleaning.

2-005
Badura, G. Standardization of transport equipment in the hospital. Veska (Aarau), 30(10):1130+, Oct.1966. [1117, Hospital Abstracts, 7(7), 1967].

In a "universal" standard container designed by the author and supplied in several sizes of uniform shape, almost all articles (e.g., food, drugs, bandages, letters, postal packages and documents, stationery, tools, cleaning materials, refuse, flowers, biological speciments, laboratory supplies) used in all hospitals can be most satisfactorily transported. The containers fit standard trolleys designed for ease of movement in corridors and lifts. Since space is saved and costs of servicing and repairs are reduced, use of the containers results in appreciable economics. A diagram showing routes for containers in a 1200-bed hospital, illustrations of containers and trolleys and of a lift loaded with trolleys carrying containers, and photographs showing how articles are best carried and moved by hand are included.

2-006
Baird, G. The design of hospital disposal chutes: chute usage patterns, Hospital Engineer (London), 23(2):25-30+, Feb. 1969. [1184, Hospital Abstracts, 9(8), 1969].

The main objective of this study was to obtain fundamental information on how chutes were used in the practical hospital situation, and to assess just how much coincident usage of more than one entry point took place. The method adopted was to monitor the use of two multi-flow chutes at the London Hospital and one at the Middlesex Hospital; results from a similar study at Addenbrooke's Hospital, Cambridge, are also included. The report covers: (i) daily usage patterns; (ii) duration of the use of the entry points; and (iii) incidence of simultaneous usage. The results show that about three percent of the usage might be expected to overlap for a two-entry chute, seven percent for a five-entry and 12 percent for a nine-entry. Generally speaking, the duration of coincident usage was less than half a minute. The likely number of collisions is very small. Other conclusions are: (i) the amount of airborne bacteria due to air being blown out of an open chute entry door is negligible; (ii) danger to staff from descending bags can be prevented by providing an entry connection of about the same length as a full bag; and (iii) jamming in the main trunking is virtually nonexistent.

2-007

Baird, G. The design of hospital disposal chutes: deceleration tracks. Hospital Engineer (London), 22(12):267-271, Dec. 1968. [1095, Hospital Abstracts, 9(7), 1969].

The author describes tests carried out on a six-inch diameter model chute for hospital waste disposal bags, using curved deceleration tracks to slow up and stop material which has descended from upper floors. The tests showed that this type of deceleration track will work with any reasonable configuration and radius of bends or troughs. The advantages of these deceleration tracks are: (i) the risk of damage to bags is obviated; (ii) if a guard is fitted over the top of the initial bend the danger to porters should be minimal; (iii) the design is simple, compact and inherently foolproof; and (iv) bags of material from different floors and of different weights will be distributed over the floor of the exit room and will not all drop on the same spot.

2-008

Bentz, F.T. A hospital reviews its automatic materials distribution system. Hospitals, 43(3):91-95, Feb. 1, 1969.

The author describes the two-channel, automatic horizontal-vertical (H-V) conveyor system utilized by the Veterans Administration Hospital in Washington, D.C., in addition to a food service tray conveyor system and an automatic sorting pneumatic tube system. The soiled channel of the H-V system is used to convey soiled items (except linens) from nursing units to processing and distribution areas and solid waste from the nursing units to disposal areas. The author points out advantages and disadvantages of the system, especially in terms of the considerable manpower required for its operation. He concludes that amortization of automatic materials handling equipment should be questioned in depth by an exacting advanced study of projected costs and benefits.

2-009
Bolles, E.H. Incorporating safety into housekeeping procedures. Hospitals, 38(12):110-115, June 16, 1964.

Sanitation, fire prevention, cost, ease, and noise control must be considered in refuse disposal. Plastic liners minimize contact with wastes, but the liners are flammable and may produce toxic fumes when burning. Fire hazards can be reduced by using metal waste receptacles, covered to eliminate oxygen, and preventing accumulation of refuse in the hospital. Bottles, glassware, and needles should be disposed of separately from refuse intended for the incinerator to avoid injury to personnel. Pressurized cans must be kept out of the incinerator to avoid explosions.

2-010
Boudreau, E.M. Meeting the new requirements for hospital materials handling. Hospitals, 43(3):42-46, Feb. 1, 1969.

Changes in the volume and bulk of materials used in the hospital should be considered in planning hospital physical plants. Concern should be directed to automated materials handling, warehousing, distribution, reprocessing, and disposal. Stringent air pollution regulations require that the planner consider other methods of waste volume reduction. The author discusses chute waste systems, hydropulpers, and stationary packer applications for the hospital.

2-011
Burt, M.L. Having trash trouble? This method makes collection simpler. Modern Hospital, 65(1):112, July 1945.

Mountainside Hospital in Montclaire, New Jersey, used fabric bag-liners in waste receptacles. By using fabric liners and collecting the full bags twice daily on a regular route, instead of carting metal receptacles to disposal areas, the hospital saved time and eliminated noise.

2-012
Cabot, E.E. Dietary departments pollute the environment with air, water, solid wastes, radiation, noise. Modern Hospital, 119(4): 136, Oct. 1972.

The author describes six ways that hospital dietary departments pollute the environment: dirty air and water, solid wastes, radiation, environmental chemicals, and noise. "Solid waste can pollute air, water and soil when it is stored in the hospital building or in containers outside."

2-013
Cadmus, R.R. One-use waste receptacles minimize infection spread. Hospitals, 32(24):82-84, Dec. 16, 1958.

When contaminated refuse is dumped or handled, there is a danger of releasing pathogens into the air. Liners are not completely satisfactory since they are difficult to close securely and the cans still require cleaning. The author describes experience with specially designed corrugated paper refuse receptacles. When full, a receptacle is closed and taken to the incinerator without opening. Refuse handling is greatly simplified, and cost reductions are realized for labor, can purchase, can liners, etc., resulting in no net cost increase. A disposable room waste paper basket was also considered.

2-014
Can liners simplify waste disposal. Safety Maintenance, 139:53, Aug. 1965.

An independent research firm compared the use of waste receptacles with and without disposable plastic liners. The lined receptacles required only infrequent cleaning with little or no scrubbing. Receptacles without liners required more handling, and, therefore, wore out faster. Waste receptacles ranged from 10 to 55 gallons in capacity.

2-015
Caswell, W.T., et al. Staphylococcal hospital infections. Hospital Topics, 36(7):83-89+, July 1958.

Dr. Caswell stated that autoclaving dressings before disposal is effective in reducing transmission of infection. This precaution is useful because bags containing such wastes might break and may be transported "...all through the hospital..." Other persons discussing the problem supported similar treatment of used dressings.

2-016
Collins, C. Sophisticated systems for handling solid waste. Waste Age, 2(3):26-27+, May-June 1971. [16333, SWIRS].

The Automated Vacuum Collection (AVAC) system marketed in the United States by Envirogenics Company, a subsidiary of Aerojet-General Corporation, is a waste collection system designed for high-rise apartments, hospitals, and other installations that produce a large volume of refuse. In this system, refuse is dropped into gravity chutes and is stored temporarily at the bottom. It is then dropped into lateral vacuum pipes which carry it to a storage silo which may be as far as 1 mile away. Paper in these tubes may move at 60 mph, while glass moves at 10 mph. In hospitals or hotels, a laundry-chute system can parallel the waste system, further reducing costs and interference with other activities in the halls and elevators. Trash is collected in a central service area, where it can be compacted, incinerated, or processed in some other way for disposal. Numerous chutes can empty into a system operating on an automatic cycle. The discharge valve at the bottom of the gravity chute opens to permit trash to be sucked out; all other valves are kept locked. The process is continued along the system until all chutes are emptied; this could be done hourly, daily, or whenever the refuse level reaches a certain point. AVAC was developed in Sweden and is in fairly wide use in Europe. Two U.S. installations are scheduled to be completed this summer - one at Disney World in Florida, and the other at the Martin Luther King Memorial Hospital in Los Angeles. Individually designed for each building complex, AVAC systems cost between $40,000 and $1 million. Illustrations of the system are included.

2-017
Color-coded paper sacks for hospital. Nursing Times (London), 56(2): 44, Jan. 8, 1960.

Bags color-coded to indicate contents and held on wheeled, covered metal frames are used instead of refuse receptacles.

2-018
Comments on the disposition of vials and disposable syringes and needles. South Dakota Journal of Medicine, 19:31-32, Jan. 1966.

A Sioux Falls boy was found to have over 150 needles and syringes and numerous cartridges partly filled with novacain, all picked out of refuse cans at medical and dental offices. The boy had injected novacain into a rat and a rabbit. Other school children were using disposable needles and syringes to refill cartridge pens. Syringes and needles should be emptied and broken, and refuse containers should be kept indoors until picked up for disposal.

2-019
Complex system set up by contractor for Naval Hospital. Solid Wastes Management - Refuse Removal Journal, 12(8):30+, Aug. 1969.
[10220, SWIRS].

After a 10 day survey of the situation of the Naval Hospital, Shayne Brothers Inc., placed 10 cu yd Dempster Dumpsters at a number of high traffic points. An open truck to pick up refuse from the various personal residences at the hospital was also added. The dead animals required unusual handling and were placed in a deep freeze unit and, when frozen solid, put in sacks and hauled away to a special location where they were burned. The same truck was also responsible for carrying all contagious diseases waste. The carpenter shop was given a special container for sawdust and odd sized wood. Since the hospital burned coal, Shayne picked up the ash residue on a regular basis. As the institution grew, Shayne Bros. installed new, more advanced equipment. On location currently are 25 front end loader containers, ranging from 3 to 8 yds. Some 100 30-gal containers are used at locations that do not generate much waste. Two large roll-off containers for bulky items, such as discarded furniture, beds and cabinets, are placed at remote, but accessible locations. The containers are steam cleaned each day with live steam.

2-020
Connolly, J.A., ed. Abstracts; Selected Patents on Refuse Handling Facilities for Buildings. Public Health Service Publication No. 1793. Washington, U.S. Government Printing Office, 1968. 320 p. [68-0038, Solid Waste Management, 1968].

This volume contains 261 abstracts of patented equipment and methods for refuse handling in residential and office buildings; however, these inventions are not necessarily limited to use within buildings. Areas of interest include baling machines, bulk presses, refuse chutes, crushers, domestic and on-site compactors, grinders, sackholders, receptacles, refuse vehicles with detachable containers, and miscellaneous items. Equipment diagrams accompany many of the abstracts. Indices of contributing inventors and supporting companies are supplied. The collection is designed to aid investigators seeking original ideas for solid waste handling. The objectives of each invention, as well as the apparatus involved in its use, are presented.

2-021
Could this happen where you are. S. Dakota Nurse, 9:2, Sept.-Dec., 1965.

Proper disposal of drugs, syringes, and needles should be of concern to all in the medical and allied professions. In 1965 two incidents occured in Sioux Falls which indicate the seriousness of the problem. One boy picked up 150 disposable needles and syringes, 8 partially full, and 16 vials of various drugs and vaccines, all from the cans outside various practitioners' offices. Another child picked up similar items from a container behind a drug store. Needles and syringes should be emptied and broken, vials and cartridges emptied, and trash containers kept inside the office until just before collection.

2-022
Cramfelt, G. Chute for laundry and hospital wastes. Sjukhuset (Goteborg), 40(5):115, May 1963. [1637, Hospital Abstracts, 3(11), 1963].

This article is one of the series on the programming of Uppsala Hospital. The two older methods of disposal of laundry and waste are discussed: collection of bags from the ward is unhygienic and uneconomical, and the system of separate chutes for unwrapped materials is very unhygienic. The two systems can be combined, and paper bags of laundry or waste dropped down a common chute. In trials with full, standard double-walled bags dropped from a height of 16 m., 70 per cent burst open. Since the hospital was to be 30 m. high, a method of deceleration had to be devised. Each shaft now terminates in an open partial helix of stainless steel, just below the ceiling of the collecting room. The system has been in use for eight months, the bags being clearly marked "Laundry" or "Waste", and there has been no damage to bags. The braking track is figured from above and from the side.

2-023
Crone, J., and R. Millard. Disposal system fights fire and infection. Modern Hospital, 101(6):132-134, Dec. 1963.

The model Addenbrook Hospital at Cambridge, England, was designed with an automatic waste disposal system intended to avoid cross-contamination and to protect against human failure. Refuse disposal was identified as one of the major problems facing hospitals, including the hazards of fire and cross-contamination. Refuse in disposable polyethylene bags, could be deposited in the chute only through airlocks.

2-024
Davies, A.G. Hospital waste problems. Public Cleansing (London), 54(3): 807, Mar. 1964. [64-0048, Solid Waste Management, 1964]

Guy's Hospital in Southwark, England, uses the paper sack system of refuse storage. Difficulty with wet kitchen waste can be solved by switching to a bag with a waxed inner lining. Paper bags are expensive, but they are more sanitary and easier to handle than conventional containers. The loaded bags are burned in incinerators adjoining each ward. The possible effects if the system were expanded throughout the United Kingdom are considered. The chute system's adaptability to hospital life and chute sanitation are discussed.

2-025
Davis, R.W. Automated waste disposal systems are coming. Modern Hospital, 111(1):138+, July 1968. [68-0042, Solid Waste Management, 1968].

Hospitals, with an estimated 12 pounds of waste per bed per day, have had the choice of incinerating it or having it trucked away. Incinerating waste involves manual charging and cleaning. Problems associated with this are: increasing labor cost, improper charging, incomplete burning, fly ash, and fire hazards. Removal of waste by truck will cost more each year because trucking costs and the amount of waste to be removed continue to increase. A truly automated waste disposal system, the result of improvisations on the Friesen concept of hospital material processing and distribution, is not available. In each department in the hospital, waste material should be placed in containers lined with disposable plastic bags. At scheduled periods the bagged waste is collected and removed, preferably by an automatic cart transportation system which conveys the waste and reprocessible items to a centralized decontamination room. All reusable items are sorted and automatically washed and sterilized. All waste material is dropped into a "waste pulping unit," where it is mixed with chemically treated water to control odors and contamination. The resulting slurry is piped to a "water press unit" which extracts most of the water, leaving a semi-dry homogeneous pulp. This pulp can be fed into a small incinerator, ensuring an odorless and smokeless operation, and pathological waste could be manually fed at any time. A surge bin is used to hold the excess waste pulp until it can be fed. The automated incinerator could pay for itself in two years.

2-026
Deschambeau, G.L. Modern hospital methods: disposal for disposables. Modern Hospital, 105(1):30, July 1965.

Lutheran General Hospital of Park Ridge, Illinois, uses empty coffee cans to collect disposable needles and syringes safely. The plastic top is cut slightly, so that half of the top lifts up by means of a hinge action. Filled cans are taped shut and sent through the hospital's crushing device.

2-027
Deschambeau, G.L. No more stray shots from disposable needles and syringes. Modern Hospital, 109(3):80, Sept. 1967.

Claiming that disposable syringes are as dangerous as a loaded gun, the author recommends that used syringes not be discarded into wastebaskets which poses a hazard to housekeeping employees and leaves the syringe available to be taken and used by others. To account for each used needle, the Monroe Memorial Hospital in Ocala, Florida distributes color-coded syringes from a rack containing 4 rows of 12 syringes. The nurse recovers the used needle with its sheath and returns the needle to the rack. Every hour central services makes a direct one-for-one exchange following the color code. The used needles are bent until broken.

2-028
Design of New Riverside promotes good housekeeping, infection control. Hospital Administration in Canada (Don Mills, Ontario), 9(4):38-40, Apr. 1967.

This article describes features incorporated into the hospital design to reduce cross infection. Waste disposal chutes are carefully planned. Waste material is bagged and fed through the chutes into a disposal cart in the incineration area.

2-029
Disposing of waste ether cans. Anesthesiology, 24(2):255, Mar.-Apr. 1963.

Disposal of waste ether cans presents fire and explosion hazards. When mixed with other wastes, ether vapor can be ignited by a stray spark caused by handling, hot matches, or discarded cigarettes. However, punching several holes in the bottom of the can, will dissipate ether vapor more readily, reducing the hazard.

2-030
Drabe, O., and G. Persson. Transport and communications in Varberg Hospital. Sjukhuset, (Goteborg), 49(1):20+, 1972. [642, Hospital Abstracts, 12(5), 1972].

The new Varberg Hospital is to have 750 beds, 300 being in a semi-independent psychiatric block; the hospital is not to be extended for many years. The site, on a windy coast, precluded tower blocks. Flow volumes were calculated in 1965, and the costs of internal transport were analysed for five different projects. The various departments in the medical block were sited to form "communication zones". Out-patient facilities are on ground level; staff and visitors have a separate entrance giving direct access to the lifts in the ward block. Deliveries come to a central yard opening into the central kitchens, stores, waste terminal, linen terminals, workshops, boiler house, mortuary and garage. Goods and waste are moved internally in a culvert system. A transport centre is responsible for transporting patients, post and messages, medicines, waste, dirty linen and other normal portering jobs, and the gardening. The transport of food, supplies, clean linen, and sterile goods is decentralized. Communications are by conventional electric trucks, lifts, etc.; the transport staff deliver indoors to a strict timetable. This division between centralized and decentralized transport services is an economical and efficient solution. The paper is illustrated with an elevation and two ground plans.

2-031
Duke, R.Q. How to plan space for sanitation storage. Modern Hospital, 97(2):122+, Aug. 1961.

The article describes the space needed and functional requirements of space to be allocated for housekeeping supplies and personnel. Buildings with food service facilities must have space allocated for food waste storage containers and container washing devices. The value of this space should be weighed against the installation of sink grinders or an incinerator to handle the food waste.

2-032
Engley, F.B., Jr. Biological interrelationships. Hospitals, 46(20): 83-85+, Oct. 16, 1972.

Although the hospital's primary function is the delivery of health care, the hospital also must monitor and control the infection hazards inherent in its constant interaction with the surrounding community served by the hospital. Because the hospital is neither physically nor biologically separate from the community, infection control within the hospital-community relationship involves numerous interdependencies between the institution and the community. In this context, the author discusses personnel; visitors, vendors, and patients; departmental responsibility; the laboratory; the pharmacy; control and isolation; as well as hospital waste. In solid waste handling the location and design of refuse containers is important to prevent the spread of organisms within the hospital to the hands of workers or into the hospital air; or outside the hospital to insects and rodents. Locating the containers near the hospital entrances or receiving docks where food or sterile supplies are delivered can be a hazard. Hospital waste should be incinerated but because of restrictions, disposal in a sanitary landfill is appropriate.

2-033
Ericson, M.H. Selecting and testing potentially useful items. Hospitals, 38(23):61-66, Dec. 1964.

Discarded disposable plastic jars provided receptacles for used disposable needles. When filled, the lids were taped shut and the jars were placed into a "sharps" container for disposal. Waxed paper bags were used for disposal of soiled one-use incontinent pads.

2-034
Falick, J. Waste handling in hospitals. Architectural and Engineering News, 7(11):46-53, Nov. 1965. [13540, SWIRS].

The increase in the use of disposable items by hospitals has changed both the composition and the amount of wastes generated. Six principles for establishing a waste handling system are formulated. (1) Almost all categories of wastes should be able to be processed by the system; (2) the system should be closed from the point of generation to the point of uncontaminated product removal; (3) it should be automated; (4) it should use waste to reduce operating costs-by 1975 hospitals will produce waste with a heat potential of 14,000 Btu per day; (5) the system should be flexible; and (6) packaging, containers, and materials purchased should be disposable and fit size requirements of the system. An ideal system including clean transportation, drying of slurry, incineration, and heat use is described. Old systems can be updated by changing collection, processing, utilization, and disposal methods, or by appending new methods to the old system. An efficient system is economical, easy to operate, and most important, safe.

2-035
Faulkner, A.C. Horizontal and vertical transportation. Hospitals, 36(5):90-91+, Mar. 1962.

Although refuse chutes may be "great conveniences", they must be designed to avoid fire hazard and operated by trained personnel. Refuse chutes must be properly vented, have sprinklers for control of fires, preclude trash accumulation at the bottom, and, if discharge is directly to an incinerator, close automatically when a fire is burning in the incinerator. Personnel must be trained to not deposit certain materials in the chute.

2-036
Forget, M. Internal transport. Techniques Hospitalieres (Paris), 21(245):102-106, Feb. 1966. [242, Hospital Abstracts, 7(2), 1967].

The four main requirements for internal transport are speed, efficiency, comfort, and economy. Transport will be largely horizontal or vertical according to the style of the building, but corridors or lift shafts must be sound-absorbent, and division of types of traffic is advisable. The use of admission beds is recommended; by being put straight into a mobile bed the patient avoids painful transfers from stretcher or wheelchair, and there is no difficulty about the return of the bed as it can be substituted for one from the ward. Separate routes for visitors and staff are recommended, with adequate sign-posting. Stores should be placed so as to allow easy delivery of goods. The distribution of meals will vary according to whether they are served in a block hospital from a central kitchen or to pavilion-type buildings. Other materials requiring transport include medicines, dressings, laboratory speciments, X-ray plates and equipment, and administrative papers. The movement of clean and soiled linen should be allowed for in the original hospital plan. Special care should be taken in the disposal of waste which should be kept in separate categories, for example, kitchen scraps, breakages, and dressings.

2-037
$14,000 annual savings with new disposal system reported. Executive Housekeeper, 11:34-35, Mar. 1965.

Disposable paper bags in attractive enclosed holders have replaced cans with polyethylene liners at a Philadelphia medical center. The filled bags still are fed to a compression unit. Because polyethylene bags sometimes tore or slipped down from the can's top, the can would be soiled and require cleaning. Containers and liners cost the same for both systems, but the paper bags system saved $14,000 a year by reducing cleaning requirements.

2-038
Foxhall, W.B. Hospital Automation. Architectural Record, 145(3):149-152, Mar. 1969.

Since personnel costs are the largest component of medical care cost, efforts to control these costs turn to mechanical automation and operation. Hospitals frequently are compared to industrial plants except for the hospitals' stringent requirements for asepsis and patient comfort. The article discusses automated materials handing systems such as pneumatic linen and trash systems.

2-039

Garry, R. Materials handling...wastes and linens. Executive Housekeeper, 19(1):66+, Feb. 1972.

Warning against tradition as the "chief adversary" of economical materials handling in hospitals, the author recommends centralization of materials distribution and flow, particularly in conjunction with the cart exchange system. In that system wheeled carts filled with the required supplies are delivered to the point of use to serve as "floating" storage units; the next day the depleted cart is exchanged for a freshly filled cart. Waste removal is another materials handling area of increasing importance as disposables become more popular. "The problems attached to disposables are not created by pre-use distribution (with the exception of required storage space) but, instead, by post-use disposal." The author suggests packaging the wastes at the point of end use, then briefly discusses internal collection methods and ultimate disposal methods (including incineration, pulping, and compaction).

2-040
Gaulin, R.P. Design Features Affecting Asepsis in the Hospital. Public Health Service Publication No. 930-D-9. Washington, U.S. Government Printing Office, 1967. 10 p.

Although chutes efficiently transport solid waste, they pose a definite fire hazard so that charging doors should be located in well-ventilated, fireproof chute rooms. Furthermore, trash chutes are difficult to keep clean and can harbor vermin. Storage areas for dietary wastes "should be in a separate area easily accessible to the outside for direct pickup of refuse'. Food preparation and dishwashing areas should have waste disposers if approved locally.

2-041
Goates, L.B. Our trash problems are in the bag. Hospital Topics, 38(1):75-76, Jan. 1960.

Plastic bags lined refuse receptacles at the hospital described in this article. The bags were closed, collected in a covered cart, and dropped down a refuse chute for incineration. Glass, needles, and other sharps were collected separately. The incinerator had a shelf to dry pathologic wastes before they were burned, and the incinerator attendant wore gloves and a mask.

2-042
Gohr, F. Hospital sanitation. The Sanitarian, 23(2):75-78, Sept./Oct. 1960.

Adequate waste disposal, storage, and collection are basic requirements of hospital sanitation. Some hospital waste is especially infectious, and requires special handling. Potentially infected wastes are usually placed in bags lining containers, closed, collected, and incinerated. Dressings may be autoclaved before disposal. Refuse chutes may contain contaminated air, which can contaminate patient care areas.

2-043
Gombkoto, J.L. Handling isolation unit waste. Executive Housekeeper, 16:12, June 1969.

The author describes a disposable container for use in isolation units as further protection against the possibility of cross infection. The container is made of corrugated board with an internal plastic coating for moisture resistance. When full the containers are placed in polyethylene bags, sealed and incinerated.

2-044
Goodman, R.H., et al. Progress report on Greenwich District Hospital. British Hospital Journal & Social Service Review (London), 77(4029): 1262-1265, July 7, 1967. [537, Hospital Abstracts, 8(4), 1968].

The main theme of the second progress report on the planning of the new District Hospital, Greenwich, recently presented at the Hospital Centre, was supply and distribution systems. The designers had studied the operational and design implications and aimed to produce a model system which others could study and improve on. The hospital is on a restricted site and comprises a low compact building with a peripheral banding of nursing departments. Each main floor has its own supply and disposal centre. Noisy, heat-producing, and traffic-producing facilities are sited in an on-site "industrial zone". Organization and methods studies led to the selection of escalators as most suitable for moving ambulant people between floors. The main storage areas will be located on the lower ground floor from whence goods will be transferred to each floor supply centre. Food is prepared but not cooked in the basement kitchen and then delivered to each floor. Milk is distributed in cartons. Disposal of waste is by chute and a comparative study showed that six would be cheaper than two. The paternoster lift forms the vertical stage of a sequence including conveyor belts and motorized trolleys. The bed-lifts are available as alternative emergency means of vertical movement. Diagrams showing distribution of specialties, disposal traffic, and distribution circuit are included.

2-045
Grapski, L.F. and H.D. Sanders. An automated materials processing and distribution system. Hospitals, 42(2):77-81, Jan. 16, 1968. [1624, Hospital Abstracts, 8(11), 1968].

The automated materials processing and distribution system which has been incorporated into the new Loyola University Hospital, Hines, Ill., handles: (i) material and equipment used in diagnosis and patient care; (ii) distribution of food trays a d return of used crockery; (iii) linen and housekeeping supplies; (iv) distribution of supplies; (v) return of waste materials; and (vi) distribution of mail, drugs, medical records, etc. The heart of the system is a central processing and despatch area located in the lower level of the core of the hospital, around which are grouped the major departments concerned with supplies--kitchens, pharmacy, central supply, linen department, etc. Stainless steel containers of 32 cu. feet capacity will distribute material on towline conveyors which allow automatic switching into the appropriate vertical shafts, horizontal tunnels, or storage areas. A control board will chart electronically the position and status of each conveyor and a "dispatcher" will monitor and control the system from the central area. The paper is illustrated with photographs and plans.

2-046
Greenberg, A. Environmental control in hospital design. Architectural Record, 136(4):202-206, Oct. 1964.

Design of transportation and communications systems affects asepsis. Transportation includes elevators, dumbwaiters, and conveyor systems. Conveyor systems include central vacuum cleaning, as well as systems for handling contaminated materials and trash. Incinerator and linen chutes should never be used unless chute doors are interlocking. Chute doors should be located in an anteroom so that anyone using the chute does not expose public areas to possible contamination.

2-047
Greene, V.W., et al. Microbiological contamination of hospital air-part I - quantitative studies. Applied Microbiology, 10(6):568+, Nov. 1962. [115, Refuse Collection and Disposal, 1962-1963].

The levels of airborne contamination in various areas of two hospitals were determined during a 15-month sampling period, using Caselia and Anderson volumetric samplers. Based on nearly 5,000 samples, the mean count per cubic foot ranged from 4.5 in obstetric-gynecology delivery rooms to 72.4 in waste-handling areas. The mean count for the entire hospital environment was on the order of 20 contaminants per cubic foot; 48 percent were associated with particles greater than 5 micron diameter; 30 percent with particles between 2 and 6 micron diameter, and 22 percent with particles less than 2 micron diameter. The airborne contamination was influenced by traffic, activity, ventilation considerations, and gross surface contamination, but not markedly by seasonal changes. When suitable control measures were implemented, the level of contamination could be diminished and kept low.

2-048
Greene, V.W., et al. Microbiological contamination of hospital air-part II - qualitative studies. Applied Microbiology, 10(6):567+, Nov. 1962. [116, Refuse Collection and Disposal, 1962-1963].

Over 10,000 airborne microorganisms, isolated from various areas of 2 hospitals, were characterized according to colonial and microscopic morphology and certain physiological reactions, including penicillin resistance and hemolysis. On the basis of all isolates examined during a 15-month period, 42.6 percent were gram-positive cocci, 19.2 percent were gram-positive rods, 14 percent were gram-negative rods, 17.1 percent were molds. 2.2 percent were actinomycetes, 1.2 percent were yeasts, and the remainder were assorted diphtheroids and coccabacillary types. The distribution of types varied according to hospital area, locations within a given area, and level of gross airborne contamination, but did not vary significantly with season of the year. There appeared to be some relationship between contaminant particle size and type of organism associated with the particle. Distribution of penicillin-resistant types differed markedly in different hospital areas, with proportions ranging from 21.4 percent in surgery areas to 4.3 percent in incinerator rooms. Of all gram-positive cocci isolated, 34.9 percent were hemolytic and 16.4 percent were penicillin-resistant.

2-049
Grosse, W. Los Angeles General invents a cleaner, faster method of ward refuse disposal. Hospitals, 35(1):85-86, Jan. 1961. [77, Refuse Collection and Disposal, 1960-1961].

A black polyethylene plastic bag, attached to the top of a linen hamper serves as a garbage receptacle at Los Angeles General Hospital. After the meals have been served, the bag is knotted at the top and transported from the wards to a double-chamber incinerator where the bag and contents are tossed directly into the fire pit.

2-050
Hahnchen, K. Management systems in new hospitals, statement of aims, organizational principles, profitability. Krankenhaus Umschau, (Kulmbach), 41(2):134-138, Feb. 1972. [945, Hospital Abstracts, 12(7), 1972].

Capital and running costs for hospitals are, at present, increasing at the rate of 10-20 percent per year. Automated systems for receiving, storing, sorting, processing, conveying and clearing goods and disposing of refuse, especially when they are coordinated in all appropriate departments and are controlled by data processing equipment, can increase efficiency and save labour and reduce costs. Thus, a system automatically maintaining the flow of goods throughout a 500-bed hospital may save DM 500,000 yearly. It should be subjected regularly to analysis and modified as required. Three diagrams are included.

2-051
Hall, L.B. Sanitation: a part of the hospital program. Industrial Medicine and Surgery, 31(5):223-225, May 1960.

Highly contaminated wastes rarely are handled with appropriate care. These wastes should be stored in a container with a plastic liner. The liner should be closed and precautions taken to keep dissemination of organisms to a minimum. Disposal should achieve isolation or destruction of organisms.

2-052
Hallinan, E. Rubbish disposal simplified. Modern Hospital, 64(4):118, Apr. 1945.

At Massachusetts General Hospital in Boston, rubbish was collected in repainted empty oil drums. The drums, mounted on coasters, could be readily wheeled to the disposal area when full, avoiding the transfer of refuse into other containers.

2-053
Harris, D. Trash Collection and Disposal System. Ann Arbor, Community Systems Foundation, 1965. 25 p. [HU2-6809, Abstracts of Hospital Management Studies, Vol. VIII, 1972].

Study examines trash collection and disposal function at Flint, Michigan. Ways to improve methods and redistribute and reduce man-hours spent by maintenance personnel are determined. Analysis of present system shows that the sole employee cannot complete and duties assigned due to uneven workload. Proposed system given more balanced workload, has each department include preliminary disposal steps previously done by maintenance man (such as separating burnables, and putting needle covers on syringes), and provides for another maintenance employee. Author recommends housekeeping personnel assume trash collection and disposal function. Cost analysis of staffing changes shows $2,225.00 net cost reduction. Appendices include comparisons of present and proposed work schedules and design for modified collection cart.

2-054
Hechinger, S. Huge pneumatic tube system moves laundry and trash. Modern Hospital, 113(1):128+, July 1969.

A pneumatic tube system is being implemented in hospitals to transport refuse and soiled linen. The chutes, gravity-fed and under negative pressure, transport material at 60 m.p.h. to any distance or elevation desired. A typical system installed by the 350 bed Lowenstorm Hospital outside Stockholm contains 3300 feet of 20" diameter tubing, 2000 feet of which are for refuse and the rest for linen. In addition to silence, simplicity, and ease of maintenance, the pneumatic system eliminates problems of bacteria dispersal throughout the hospital and reportedly offers a significant labor savings. For example, the Lowenstorm installation costs only $4/day because the pump operates only when the holding section requires emptying. The total bill for a 750 bed hospital is estimated at $500,000. Mount Sinai Hospital in New York and Martin Luther King Jr. Hospital in Los Angeles are using this system now.

2-055
Heisler, W. Organization of transport and communications. Osterreichische Krankenhaus-Zeitung (Wien), 9(11):471-474+, Nov. 1968. [887, Hospital Abstracts, 9(6), 1969].

In this comprehensive paper the author discusses the value to a hospital of efficient mechanization; centralization; bulk supply; intake and removal of materials; messenger service; use of disposable articles; internal and external transport; conveyors and lifts; disposal of refuse; call, communications, tape recording and dictating systems and monitoring and television equipment. It is pointed out that, on some cases, certain functions such as laundering and the preparation of meals may, with advantage be undertaken by outside organizations.

2-056
Henrikson, V. A system for the use of paper handkerchiefs in the hospital. Sjukhuset (Goteburg), 39:121-122, June 1962. [110, Hospital Abstracts, 3(1), 1963].

The use of paper handkerchiefs by patients has many advantages but one obstacle to their use has been the difficulty of their immediate disposal at the bedside. A simple solution to this problem devised in one Swedish hospital is the use of a pocket made of white polythene which can be suspended from the side frame of the bed and which is easily accessible to the patient even when lying down. The pocket is lined with a removable paper bag which can be taken out at intervals and placed with other ward waste; a clean bag replaces it. The polythene pocket remains in use during the patient's stay (or at least for several weeks) and is replaced when the bed is being prepared for a new patient. The pockets are found to be useful not only for paper handkerchiefs but also for fruit debris, dead flowers, and newspapers. The system is appreciated by patients and reduces infection risks.

2-057
Hewer, C.L. Disposing of the undisposable. British Medical Journal (London), 3:766, Sept. 25, 1971.

This letter to the editor laments the increased use of plastic disposable syringes in hospitals, charging that disposable syringes "not only pollute the environment but increase the incidence of drug addiction." The incinerated plastic coats the inside of incinerators to "eventually ruin the destructor." Frequently used needles/syringes are scavenged and sold to drug addicts; even supposedly destroyed needles/syringes sometimes are repaired for illicit use.

2-058
Hospital environmental control--the art and the execution thereof. Air Engineering, 6:7-8, Feb. 1964.

Effective techniques of hospital environmental control appear to be better perfected in theory than in practical application. Some "modern" hospitals ten years old or less still use such anachronisms as three-story garbage chutes which do facilitate garbage removal to ground-level incinerators but, at the same time, displace contaminated air to the floors below.

2-059
Hospital x plastic liners = greater efficiency. Modern Sanitation and Building Maintenance, 17:21-22, May 1965. [65-0057, Solid Waste Management, 1965].

The housekeeper of a New Jersey hospital found that polyethylene liners cut work and improve sanitation. Before, janitors had to steam-clean swivel cans and waste baskets. Now the janitor picks up the liners and puts them into castered swivel cans which also have liners. The large liners are tied to seal off contents until burned in the incinerator.

2-060
Hospitals themselves helped in the development of a universal transport system. Technische Gids voor Ziekenhuis en Instelling (Amsterdam), 36(858): 16-18, Jan. 10, 1967. [1287, Hospital Abstracts, 7(8), 1967].

In cooperation with the German Hospital Insitute, the Swiss Hospital Centre and the British Hospital Centre a German firm has developed a universal transport system for hospitals. All vehicles are made of "Zargal", a special alloy, which claims to be lightweight, practically everlasting, rust-free and anti-static. Maria Hospital, Tilburg, received a complete set on approval, consisting of seven basic models, each of which can be supplied in various sizes: i.e., a movable clean-linen cupboard; dirty laundry trolley; dirty laundry containers; trays for articles from store-rooms, a dispensary and other equipment; under-carriages for these trays; and a trolley for waste. All parts and accessories have standard or adaptable measurements and many combinations can be made. The design is aimed to facilitate and minimize activity; for example, dirty laundry trolleys have V-shaped cut sides which make loading and unloading easier and prevent bags from falling off during transport; doors can be fixed to the sides by magnets, thus transforming cupboards or cases into a range of shelves; wheels and swivel castors are so placed that trains of vehicles can negotiate corners easily. The models are described in detail and illustrated with 10 photographs.

2-061
How to dispose of razors and needles. National Safety News, 91:37, June 1965.

A California hospital "plagued with injuries arising out of the improper disposal of needles, razors, and other sharp objects" solved its problem with a new means for collecting such articles. They were placed in polyethylene bottles, originally used for cleaning agents. The bottles were simply thrown away when full.

2-062
Hughes, H.G. Chutes in hospitals. Canadian Hospital (Toronto), 41(9):56-57+, Sept. 1964.

Major problems with chutes are fire hazards and the potential dispersal of organisms. However, chutes do conserve labor. Chutes should have fire-resistant doors which open into separate small rooms designed for easy cleaning. Air pressure in a chute should be low enough that no air flows from the chute into the hospital. Chutes should be cleaned regularly using a built-in mechanism or long-handled brushes. Fires in trash chutes most often occur when refuse accumulates at the bottom or when blockage occurs. Cigarettes and other sources of ignition must be kept away from chutes.

2-063
Hurst, V., et al. Hospital laundry and refuse chutes as source of staphylococcic cross-infection. Journal of the American Medical Association, 167(10):1223-1229, July 1958.

Exhaust air from hospital laundry and refuse chutes was found to contain "...considerable numbers of coagulose-positive penicillin-resistant staphylococci." These organisms could be released to hospital corridors when chute doors were opened. In the Moffitt Hospital, the dumbwaiter used for sterile supplies was adjacent to the refuse chute. The refuse chute "...takes all rubbish, including dressings wet with blood, serum or pus." Placentas were originally sent down the refuse chute, but this was discontinued due to problems of obstruction. Air from the chutes leaked to hospital corridors, especially those at higher levels. Releases of air from the chutes included constant leakage through cracks, large gusts when a chute door was opened, and larger gusts when opening occurred while something was passing by in the chute. "Chute staphylococci may well have been responsible for some of the infections which were hospital acquired." "A strong gust from one of the (refuse or laundry) chutes could heavily contaminate the outer wrappings of the 'sterile' surgical supplies or the bedding and garments of a patient just returning from surgery." The chute problem "demands correction." Corrective measures could include better construction, careful consideration of materials placed down chutes, and routine autoclaving of all disposable infected material.

2-064
Incinerator chute handles waste. Institutions, 51(4):115, Oct. 1962.

A gravity chute waste disposal system designed for a 28-story building is recommended for all high-rise institutions and buildings. The chutes empty into a cart which is wheeled to the incinerator, then mechanically raised and tilted to dump the contents. The operator opens the incinerator door manually.

2-065
Isaacman, T. Supplies ride the rails at Buffalo-Mercy Hospital, Modern Hospital, 116(3):93-97, Mar. 1971.

The system is a power chain conveyor enclosed in a monorail, working in conjunction with a gravity rail. Throughout the system a single rail, hanging from the ceiling, provides the path. Suspended from the rail are transporters which weigh about 100 pounds each and can carry 500 pound loads. While in motion, the carts ride several inches off the floor. Soiled supplies, used linen, and packaged waste are placed on a cart, a transporter is attached, and the code for S.P.D. (centralized Supply, Processing and Distribution) is dialed into the control unit. The car reaches the S.P.D. in a section which is walled off from the stored clean supplies, moving first into a decontamination area where soiled supplies are separated and sent on conveyors into washer sterilizers. Wastes are removed and put into a disposal unit. The cart then moves into laundry area where soiled linens are removed. Before the cart and its transporter return to the clean side of the S.P.D. to be reloaded and dispatched, they must go through a washer-sterilizer unit. Total cost of system is $455,000. According to the manufacturer's studies, a 500-bed hospital could recover the cost in about five years. The only problems encountered have been a few loose links in the chain mechanism and the cart washer's inability to completely dry the carts before ejecting them.

2-066
Isolation Techniques for Use in Hospitals. Public Health Service Publication No. 2054. Washington, U.S. Government Printing Office, 1970. 87p.

This publication details recommended practices for the control of solid wastes from specified patient isolation methods. In strict isolation areas, disposal needles and syringes should be stored in an impervious plastic bag. Similarly dressings and tissues must be contained in a tightly closed impervious plastic bag. Although no special precautions are suggested for needles and syringes in respiratory isolation areas, dressings and tissues should be placed in an impervious plastic bag, then tightly sealed and incinerated. Protective isolation areas require no special precautions with needles, syringes, dressings, or tissues.

2-067
Jones, E.W. and K. Trickett. Disposal chutes: questions and answers. Modern Hospital, 102(4):6+, Apr. 1964.

Stating that chutes are the most efficient waste transportation system, Mr. Jones suggests that the minimum diameter should be at least 28", preferably 30", rather than the standard 24". Mr. Trickett replies that linen chutes should be 24"-28" in diameter, whereas the waste chute size should be determined by the quantity and size of the waste. Plugging can be prevented by making the entry interlock smaller than the main vertical ducting.

2-068
Jopke, W.H. Environmental sanitation review. Hospitals, 42(7):49, Apr. 1, 1968.

This article deals with cross infections, bacteriological standards, sampling, infection surveillance, cleaning, plumbing, sanitation, housekeeping, and training programs.

2-069
Kohler, G. Conveyance systems in hospital building? Krankenhaus (Cologne), 61(2):54-57, Feb. 1969. [1185, Hospital Abstracts, 9(8), 1969].

An account is given of the design and use of the fully automatic, horizontal and vertical conveyor system to be installed at a cost of DM 2,600,000 in the 605-bed hospital at Herford. The electrically operated conveyors transport a variety of hygienic aluminium containers to and from loading and unloading points throughout the buildings. Some of these containers have side doors and can be used also as cupboards. They carry meals on trays, soiled crockery and cutlery, clean and soiled fabrics, articles sterilized or to be sterilized, instruments bandages, preserved blood, drugs, laboratory specimens, X-ray films, case histories, books, mail, consumer goods of all kinds and, in sacks, refuse. The containers, which can be stacked, are appropriately labelled and, if desired, coloured. Theyroll on and off the conveyors and are transported to and from the loading and unloading points on trolleys on which they move on rollers. An automatic machine for washing and sterilizing the containers is included in the system which saves labour and expense and increases the speed of transport. A pneumatic tube system conveys articles weighing not more than about one kg. A diagrammatic plan of the hospital and five photographs are included. A different system costing DM 3,000,000 is to be installed in the Waldrol District Hospital.

2-070

LeTourneau, C.U. Automated transportation of hospital materials. Hospital Management, 102(2):45-49, Aug. 1967.

This article described an automated enclosed, programmed system which delivered all hospital material to the proper stations on monorail type tracks. The author claims that no soiled articles can be sent to a clean station, "soiled stations are used for dirty dishes, soiled linens, trash, and contaminated surgical supplies."

2-071

LeTourneau, C.U., and R. Shafer. Automatic transportation in the hospital. Hospital Management, 105(5):39-40, May 1968.

A new approach to conveying materials in the hospital is a self-propelled vehicle which travels along existing hospital corridors on a course traced by a series of electronic guidewires imbedded in the floor. A single operator located in a central station programs each vehicle's destination. The system can utilize existing shafts in the hospital such as condemned trash and linen chutes.

2-072

Lewis, R.K. Handling sparking hazards. Hospitals, 37(14):50, July 16, 1963.

Unless conductive materials or certain quaternary compounds are added to plastic bags when they are manufactured, the bags or other plastic items "can serve as a reservoir for static electricity which can be activated by dropping the bags down vertical chutes." Other safety factors such as chute construction, automatic sprinklers, self-closing doors, and air-lock compartments at accumulation points help minimize sparking hazards. Bags accumulated at the chute bottom should be checked to determine if the bags are retaining inordinate amounts of static electricity.

2-073

Mackintosh, G.R. Efficient disposal of kitchen waste. New Zealand Journal of Agriculture (Auckland), 117(1):56-59, July 1968. [68-0220, Solid Waste Management, 1968].

After the Waikato Hospital Board studied its garbage disposal system, it was decided that mechanical grinding and sewerage disposal could have disadvantages which outweighted their advantages. Several costly machines and additional plumbing would be required in addition to expensive maintenance. Of most concern, however, was the waste of good pig feed. The collection room facilities at the hospital are described. Each of the hospital's three kitchens has a garbage collection room where converted 20-gal milk cans with attached lids are placed on mobile, three-wheeled trolleys and wheeled, when full. Each evening the full cans are removed and a clean can is placed on each trolley by the contractor. The advantages of this hygienic, labor-saving, and noiseless system are: no labor or transport expenses in conveying food wastes to cental collection points, no need for labor, or large quantities of boiling water and facilities formerly required to clean empty containers, no purchase of containers or frequent repair expenses, and no smells, or flies. Food waste is not stored in kitchens overnight, and stands for pig food are eliminated as is spillage resulting from tipping of waste from small drums to large containers. From the contractor's point of view, the food waste is received in better condition and a greater proportion of the waste is made available for good pig food.

2-074
Maki, E. Engineers' forum. Hospital Engineering Newsletter, 12(1):2-3, Jan. 1967.

In response to a reader's request for suggestions on how to keep trash and garbage containers clean, this chief engineer from a Michigan hospital recommends portable steam cleaners. A less practical alternative is a central cleaning station. Mr. Maki recommends using paper liners in the containers to simplify cleaning.

2-075
Mallone, T. Down the hatch--Swedish style. American Institute of Architects Journal, 53:54, Jan. 1970.

Although Sweden introduced automated vacuum waste collection nine years ago, pneumatic tubes to collect solid waste and soiled linen are just now being adopted in U.S. hospitals and institutions. A Swedish designed and tested collection system, the Automated Vacuum Collection System (AVAC), receives wastes through vertical gravity chutes connected to horizontal pneumatic pipes which move waste to a central hopper by an air stream approaching 60 mph. Institutions can employ dual systems for trash and linen; furthermore, by incorporating vacuum cleaning hoses, AVAC can pick up and remove dust, dirt, and scrubbing water. The author describes the pneumatic systems design and operation, noting that AVAC can be incorporated in new structures or added to any existing building. Advantages include elimination of costly and unsanitary features of conventional waste and linen handling methods. Labor savings alone will pay for AVAC within three to six years.

2-076
Marchant, A.J. 1984 in 1967. Public Cleansing (London), 57(4):189-196, Apr. 1967. [67-0129, Solid Waste Management, 1967].

A pneumatic system for conveying refuse over varying distances is used in Sweden. A state hospital at Solleftea has three systems: one for removal of dust and floor sweepings, another for conveyance of soiled linen, and a third for removal and conveyance of refuse to a central point; the last is known as the pneumatic refuse transportation system. The maximum distance over which refuse is to be drawn is one mile. The layout of the pneumatic system is similar to a sewerage pipe system. Incoming refuse is temporarily stored in a steel cylinder refuse silo. Final treatment is on site incineration. The filtration of dust is a dry process using six filter chambers with airtight access doors. Dust laden air is taken in at the bottom of the chambers through the cotton bags. To clean the filters, the bags are shaken allowing the dust to fall into the base of the chambers. It can be washed away into the sewerage system.

2-077
Material Handling and Assisted Movement of Patients in the Royal Columbia Hospital. Management Engineering Study MAN-00-09-68. Victoria, British Columbia Hospital Insurance Service, 1969. 135 p. [MN2039, Abstracts of Hospital Management Studies, Vol. VI, 1970].

Report of a two-month engineering study to recommend a system for materials handling in new and renovated hospital areas, an organization to implement the system, and the necessary staffing. Main tasks examined were: assisted movement of patients within hospital complex; movement of nourishment and meals to nursing units and return of containers to kitchen; movement of linen; collection and movement of waste; movement of general stores, drugs and medications from pharmacy, CSR supplies, processed forms and paper, and flowers and newspapers to and from patients; and the collection and movement of laboratory samples. Detailed recommendations were given.

2-078
Maurer, A.H. A survey of waste disposal systems. Executive Housekeeper, 3:16-18+, Apr. 1971.

This comprehensive report of factors to be considered for hospital solid waste management systems, is based on data from a 600 bed hospital/medical center. Available internal collection and transportation systems are presented as well as details on the solid waste composition, quantities of waste per bed per day, volume and weight reduction achieved, number of truckloads to be hauled away, and initial costs versus hauling charges for the various processing methods which are discussed.

2-079
McGann, J.M. Survey shows major problems in waste disposal by hospitals. Hospital Topics, 48(10):45+, Oct. 1970. [11698, SWIRS].

Paper companies are bringing some relief to hospitals, as well as other institutions and private homes, with such products as disposable paper refuse sacks, that are in use in an increasing number of establishments. But obsolete methods of storage and disposal are still most prevalent in getting rid of millions of tons of hospital garbage each year. A survey was recently conducted by the St. Regis Paper Co., to obtain information on the solid-waste disposal problem of hospitals. Of the 120 responding hospitals, 29 percent indicated that of all their housekeeping problems, collection and disposal ranked first. Seventeen percent of the hospitals reported that storage was their prime solid-waste problem. About 11 percent ranked disposal as their biggest refuse headache. Space necessary for separating waste material, such as glass, needles, blood, tissues and chemicals, is especially critical. There is also not enough space for adequately cleaning and sanitizing conventional refuse containers. Incineration is also a problem. Sometimes incinerators are too outdated to handle the load. Incinerator cleaning is expensive and time-consuming. An alternative to private incinerators is pickups by private and municipal refuse collectors. Hospitals decry the cost and time involved. The survey showed that most of the bulk of solid waste came from the kitchen/dietary area. Other areas mentioned, in order of their importance were: delivery, storage/supply, nursing service, obstetrics, pathology, pharmacy and public areas.

2-080
Meister, E. Transport in the hospital. Techniques Hospitalieres (Paris), 26(306):66-71, Mar. 1971. [1293, Hospital Abstracts, 11(9), 1971].

It is estimated that for every 100 patients in a university hospital six people are employed for an eight-hour day in transport only. The average weight of goods handled is 50 to 60 kg. per patient per day. This includes food, laundry, medical supplies and documents. The amount per head transported has been increased by the reduction of the length of stay, increased demands for medical supplies, and the increased use of sterile and disposable supplies. Increased mechanization is therefore becoming essential. One of the new systems available is Telerail von Roll 3-D, a three-dimensional monorail. This offers rapid and safe delivery of goods and reduces the demand for staff. A diagram is given illustrating a possible programme for the movement of foodstuffs, laundry, pharmaceutical supplies, post, stores and waste. Telerail 3-D can be used to link several buildings as well as different floors in the same building and extensions can be made to the original system. Each vehicle has its own electric motor, capable of different speeds, and carries a container adapted to the material to be transported. These vehicles are received automatically at the appropriate stations and the whole system, which is designed for electronic control, has effective safety devices. The system is quiet in operation and can even be used to transport people. There are 12 diagrams and photographs.

2-081

Methods know-how salvages over $10,000 a year from trash. Canadian Hospital (Toronto), 41(11):52-54, Nov. 1964.

Approaching housekeeping like a business by introducing methods analysis and encouraging staff initiative, a hospital made experts out of maids and cleaners, boosted labor out-put, and trimmed costs. Plastic bags, installed on soiled linen carts, receive wastes collected from patient rooms twice daily. Then the bags are sealed and transported by cart to an incinerator.

2-082

Michaelsen, G.S. Waste handling. In Proceedings; National Conference Institutionally Acquired Infections, Minneapolis, Sept. 4-6, 1963. Public Health Service Publication No. 1188. Atlanta, U.S. Public Health Service. 1964, p.65-69. [64-0750, Solid Waste Management, 1964].

Solid wastes in hospitals are divided into reusuable items and disposable items. In the area of disposable solid waste, the combustible trash constitutes the greatest volume as well as a highly suspected waste, which accumulates in the hospital. As a part of a study of solid waste problems, 3,186 items of 42 different kinds were found in 104 waste baskets. The potential for spread of contamination by handling this type of waste becomes serious when it is considered that the wastes are laundry hampers, carts, buckets; that some is wrapped and some is loose; some of it is wet or bloody; and some of it is stored in patients' rooms, in utility areas, in trash chutes, and in incinerator rooms. The potential hazard of handling combustible trash can be greatly reduced by using liners in all receptacles. These should be tied or stapled shut when full and transported to the point of disposal. During periods of severe overloading of incinerators, unburned or incompletely burned infectious material may escape from the incinerator stack. If the stack is close to a fresh air intake, it is then possible for infectious material to be brought back into the hospital. Non-combustible trash such as the metal parts of disposable plastic devices, plaster casts and food tins, can be buried on a trash dump or a sanitary landfill.

2-083

Minerath, M. The use of paper bags for refuse disposal. Gestions Hospitalieres (Mantes), 13:151-152, Feb. 1962. [1179, Hospital Abstracts, 2(8), 1962].

Paper bags for refuse are of varying size and types according to the material to be collected and usually made of two sheets of Kraft paper, one of which is resistant to wet. Stationary or mobile carriers are provided. The bag is held by the mouth over which a pedal-operated lid is fitted so that odours and bacteria are sealed off. When full the bag can be tightly closed. Many uses for these bags can be found in hospitals, the 30 litre size being most suitable. A ward of 50 patients would need about 20 bags per month, and the present cost per bag is 0.23 N.F. They can be bought in bulk at cheap rates and take up little storage space.

2-084

Moden, T. and O. Hallstrom. Suction transport for waste and soiled linen. V.V.S. (Stockholm), 36(8):419-427, Sept. 1965. [1863, Hospital Abstracts, 6(11), 1966].

The new 300-bed Lowenstrom Hospital is being built as a unified block containing all functions in two low wings for treatment and reception and a seven-storey ward block. In other new hospitals a planning problem as arisen on internal transport of rubbish, laundry baskets, and beds; special staff, corridors and lifts often having to be reserved for this purpose. Transport in Lowenstrom Hospital is to be by suction in a closed pneumatic tube system. Laundry sacks will be sucked to a central room with a van-loading bay. Waste and dust sucked from floors, bedding, etc., will pass along a 500 mm. tube in a 250 metre-long underground culvert to a waste-silo in the hospital heating plant. The vacuum for cleaning is delivered to wall valves throughout the building via 70 mm. tubes, to which the apparatus is connected by long flexible pipes. The paper describes the technical problems encountered and solved in construction of the system-valves, expansion joints, control of gauge, prevention of leakage at joints, and acceptance testing. The paper is illustrated with three floor plans and 16 photographs.

2-085

Negus, L. Refuse disposal is part of safety program. Modern Hospital, 92(2):134+, Feb. 1959.

An important factor in preventing disease spread is minimal handling and exposure of infected and contaminated materials, preferably disposed of by incineration. Recommending the separation of infectious combustible and noncombustible refuse, the author details in-hospital handling methods for small noncombustibles and larger noncombustibles, as well as surgical wastes. Although a sanitary landfill, preferably with a lime covering, is satisfactory for disposal of infectious noncombustibles, those materials should be incinerated before disposal in open dumps. Both combustible infectious material and surgical wastes should be incinerated. The author discusses cleaning of waste cans and trucks used for hauling wastes; protective clothing, hygiene, and training of collection personnel; and in-hospital collection methods.

2-086

New Canadian hospital is structured for an overhead monorail system. Architectural Record, 145(3):159-161, Mar. 1969.

A Canadian hospital uses and automatic cart transport system in which an overhead monorail carries electroically controlled conveyances for supplies and waste. A separate vertical elevator transports garbage and soiled materials directly to the decontamination area for sorting and automatic disposal.

2-087
Opinions and ideas: trash disposal system at Georgia Hospital. Hospitals, 36(3):30, Feb. 1, 1962.

Georgia Hospital collected trash in 55-gallon covered soap drums lined with disposable plastic bags and stored in utility rooms. Bags were closed and removed in a covered metal truck.

2-088
Oviatt, V.R. Waste handling an old problem. Technical Information Report. Hicksville, New York, Institute of Sanitation Management, Oct. 10, 1967.

Handling of hospital wastes "from the source to the point of disposal causes some of the greatest public health and safety problems." Although this primarily is an in-hospital problem, decreased use of incineration extends the problem to the surrounding community. Biological wastes, which can be a "direct source of infection to persons coming into contact with them if they are improperly handled," are of particular concern. The author lists many specific items of wastes generated in various areas of the hospital and uses "flow diagrams" to illustrate patterns of in-hospital waste collection. The cart system, the most common method, has many handling and labor problems eliminated by the gravity chute method which has serious disadvantages of its own. Pneumatic chutes, which remove waste from the environment near the point of generation while eliminating refuse collection rooms, further reduce handling and labor costs. Although pulping offers convenient transport and significant volume reduction, that system generates aerosols, increases the waste's weight, and possibly increases leaching of contaminants during ground disposal. Current research focuses on (1) grinding biological waste for direct discharge to the sewers, eliminating almost all solid waste handling in the hospital, and (2) packaging materials (i.e., types, amounts, and disposal).

2-089
Paper bags for waste disposal save hospital money. Modern Sanitation and Building Maintenance, 17(2):19-21, Feb. 1965. [65-0061, Solid Waste Management, 1965]

A Pennsylvania hospital uses bags of double-ply Kraft paper used in sizes ranging from 36 to 58 gal. capacity. They are fully enclosed in fire-proof containers while in use. Odors are sealed in; flies and pests, sealed out. There is no chance of spillage. The bag is slipped through the front where a hinged panel can be dropped down. The bag is stapled and loaded onto a cart for transfer to a compressing bin.

2-090
Peimer, S.C. How a "total disposable" program was started and made to work. Hospital Topics, 47(6):117-126, June 1969.

The introduction of a disposable program at Detroit's Sinai Hospital was accompanied by logistical waste disposal problems with tangible solutions. When building a new facility or modifying an old one, several disposal methods must be considered: (1) a chute to collection point; (2) a chute to incinerator unit; (3) transportation to a central loading point; (4) compactors with transportation to central loading or incinerator; and (5) a pulping unit. This hospital chose to compact waste on the ward, followed by on-site incineration.

2-091
Pickens, W.R. and L.H. Mousel. Surgical suite at Swedish hospital is designed to reduce contamination. Modern Hospital, 98(3):105-110+, Mar. 1962.

Swedish Hospital's design emphasized separation of clean and contaminated materials. Automatic conveyors transported clean materials to the surgical suite, avoiding areas used to transport contaminated materials. Closed bags and separate conveyor systems were used for contaminated items and refuse.

2-092
Polyethylene waste bag. Sanitar und Heizungstechnik (Dusseldorf), 33(7):446, July 1968. [5117, SWIRS]

Containers for bandages and sanitary napkins can be replaced by the "alumasc" polyethylene bag. The bag can be collected with the regular waste. The bag is especially suited for hospitals, plants and factories where mainly women are employed. The wastes are thrown into the bag which when full is hermetically sealed simply by pushing a button. The sealing process takes 9 seconds. A red light comes on and when it goes off the bag is sealed and can be taken out of the frame. The frame has rollers and can be moved. The sealing unit is operated at 6/12 volts. The input voltage is 200/250 A.C. 50/Hz, the power consumption is 500 watts.

2-093
Popkin, S.D. Institutional design. In Salkowski, M.D., ed. Disposal of Single-Use Items from Health Care Facilities; Report of the Second National Conference, Sept. 23 and 24, 1970. Monograph No. 8. Ann Arbor, National Sanitation Foundation, Sept. 1970. p. 27-28. [15537, SWIRS].

Every architect has a moral and a legal obligation to take responsible action in the design and development of the physical environment. Buildings must take into account every possible function both now and for the future. Especially at this time, innovative designs are needed to accomplish solid waste disposal. It is possible to transfer almost any product from one point to another without the assistance of an overseer. This feat is accomplished by the use of conveyors, electronically directed carriers, and many other such devices thereby saving untold hours of human time and energy. It is time to put this accomplishment to effective use, to direct solid waste through a pneumatic tube system to a collection point, and from collection point to ultimate disposal.

2-094
Portable compactors put the squeeze on waste and refuse problems. Executive Housekeeper, 19(1):72-74, Feb. 1972.

Increasingly stringent local ordinances to minimize air pollution from waste incineration are enhancing the practicality of compacting institutional wastes, either on-site or at a central collection point. Compaction ratios range from 5:1 up to 20:1 for loose wastes to minimize "storage problems for waste as well as the attendant hazards of fire and nesting of rodents and vermin." Compaction frequently results in a labor savings also. Trends in compactor use include using a compactor with a gravity chute, or using a portable compactor which can be guided along corridors compacting as it goes.

2-095
Portering services--collection of refuse and swill. In Abstracts of Efficiency Studies in the Hospital Service. No. 88. London, H.M. Stationery Office, 1965. 2 p. [HU2003, Abstracts of Hospital Management Studies, Vol. III, 1967].

Describes the changes effected in the portering service at Scotton Banks Hospital in the collection of refuse resulting in the ability of the refuse porter to carry out previous duties while absorbing the extra workload of 4 or more wards (plus a 35% reduction in vehicle mileage).

2-096
Portering services: disposal of refuse. In Abstracts of Efficiency Studies in the Hospital Service. No. 32. London, Her Majesty's Stationery Office, 1962. 2 p. [1180, Hospital Abstracts, 2(8), 1962].

The existing system of refuse disposal at Alder Hey Children's Hospital, Liverpool, using galvanized iron dustbins which were emptied daily by porters, was unhygienic and noisy. Improvement was impossible without increasing the number of porters. A method was sought of using two night porters, who were unoccupied between 5 a.m. and 6:30 a.m., to dispose of the refuse and it was decided to use paper sacks. Each bin was replaced by a paper-sack holder with a foot-pedal operated fibre glass lid. At 5 a.m. daily the two night porters, with a trolley and supply of clean sacks tour the hospital removing the full sacks, closing them with a hand stapler, and placing a new sack on each holder. The complete round takes 45 minutes, including loading the full sacks into the corporation dustcart left on the hospital premises. This system is hygienic, almost completely silent and much preferred by the porters. It has now been extended to the disposal of soiled dressings. The sack-holders cost £5.5s. each, the whole hospital being equipped for less than £150. The sacks cost 7 1/4d. each, the annual expenditure for this item being about £275. Savings achieved were: (i) the 42-hour week for porters was introduced without additional staff or extra overtime, equivalent to a saving of £900 a year; (ii) relief porters were no longer required during the summer leave period, saving £700-£800 a year; and (iii) the need to employ extra staff to reach desirable standards of hygiene was eliminated.

2-097
The problem of waste disposal. Professional Nursing Home, 4:22, Apr. 1962.

Institutional waste collection before the large scale use of disposable liners is discussed, noting the use of metal cans and fabric liners. A housekeeper must be concerned with timing, noise, method, sanitation, and appearance in the collection of refuse.

2-098
Public health aspects of refuse storage and disposal. The Sanitarian (London), 69(2):84, Nov. 1960. [72, Refuse Collection and Disposal, 1960-1961].

A discussion of sanitary methods of refuse handling. Includes: (1) refuse storage - the problem in multistory buildings, the chute system, the bulk storage container, the turntable system, and the expendable bag system; (2) refuse collection - the dustless collection system and (3) refuse disposal - the sink grinding unit, controlled tipping, and composting.

2-099
Ragazzi, C.A. The use of paper sacks in hospitals. Nuova Tecnica Ospedaliera (Milan), 12(4):163-164, Apr. 1969. [1902, Hospital Abstracts, 9(12), 1969].

Hospitals in Italy are required by law to maintain incinerators for the disposal of hospital waste; its collection and transport through the hospital buildings and grounds involves considerable hygienic hazards. The use of disposable paper sacks for the safe collection and disposal of waste is spreading. The sacks are light but strong, impermeable and untearable and tough enough to resist even the bite of rats. In use, they are hung, open-mouthed, on light wall brackets incorporating a self-closing hinged lid. They are fitted in every part of the hospital where the waste arises. When full, each sack is closed by pulling and securing a string around the top. The outside of the full bag remains quite clean and it can be safely carried away for burning. A paper sack scheme is not cheap, but there are savings on dustbins and on equipment and labour for cleansing, disinfection and other operations involved in the older system. The risks of hospital infections are reduced.

2-100
Refuse chutes standard. Public Cleansing (London), 58(5):252, May 1968. [68-0141, Solid Waste Management, 1968].

British Standard 1703 was first prepared at the request of the Building Divisional Council in order to indicate a general design and suitable materials for refuse chutes for multistory buildings. The first edition included certain matters concerning the use of domestic refuse systems which at that time were not covered by a British Standard Code of Practice, CP 306. The various methods of jointing the chute components, methods of connection with the hoppers, and general guidance on installation are covered in this code. The standard specifies requirements for refuse chutes in the form of one or more vertical pipes receiving refuse from successive floors in a building and discharging it into refuse storage containers, housed with a chamber situated at the lower end where bulk removal takes place at intervals.

2-101
Seaman, R.M. Sanitary collection of wastes in polyethylene-lined cans. Modern Sanitation and Building Maintenance, 13(8):22-23+, Aug. 1961.

The article described the use of plastic bag can-liners for refuse receptacles at the Methodist Hospital in Memphis, Tennessee. A porter would remove the bag, staple it shut, spray the can inside and out with 2% phenol solution, and replace the liner. Savings in cost, lessening of noise, and better sanitation resulted from the use of the plastic bags.

2-102
Sonder, R., and J.L. Russo. How to get things moving. Modern Hospital, 105(2):120-127, Aug. 1965.

The success of a vertical hospital plan depends largely on selection and location of the proper type of vertical transport system. The increasing use of disposables means a severe jump in waste volume, a matter for serious concern. The disposal and movement of these wastes must be handled expeditiously and economically. Movement by chutes, incinerators, and pulping machine circuits must be weighed against the use of closed carts on elevators. The author describes each system.

2-103
Speedy and hygienic suction refuse disposal. Instelling & Management, (Den Haag), 1(9):440-441, Dec. 1969. [752, Hospital Abstracts, 10(5), 1970].

A Swedish method for the central collection of waste, using an automatic vacuum system which carries waste materials via tubes of from 500 to 600 mm. in diameter is described. The waste is finally transported by the tube to the incinerator plant for burning. They system can be combined with a central vacuum cleaning installation and a laundry transport system.

2-104
Starkey, H. Control of staphylococcal infections in hospitals. The Canadian Medical Association Journal (Toronto), 75(5):371-380, Sept. 1, 1956.

Tissues and other possibly contaminated materials commonly were thrown into waste receptacles. "At least for contaminated areas, only disposable paper bags should be used for waste". Contamination of the environment increased when the staff allowed certain practices, including "safe waste disposal", to lapse. Waste handling probably was the largest factor in transmission of infection.

2-105
Steinle, J.G. Consultant's corner. Hospital Topics, 44(2):68, Feb. 1966.

Because laundry and rubbish chutes can be fire hazards and contribute to the spread of infection, chute doors should be self-closing and self-locking,features which require maintenance. Furthermore, washing chutes adequately is difficult. Sprinkler heads at the chute's top and other washing systems have been tried, but chutes are "very expensive if properly installed with sprinkler and washing heads." New construction frequently omits chutes in favor of contracting pickup and delivery service. Handling at the terminal posed the greatest danger with refuse chutes. A Pennsylvania survey of 98 refuse chutes showed that "26 had been discontinued and 32 were being used on an exceedingly controlled and limited basis."

2-106
Supply ramp is core of new hospital. Modern Hospital, 104(2):99-100, Feb. 1965.

The all-new Greater Baltimore Medical Center is built around a unique core consisting of a spiral, inclined ramp for "locomotive" (tractor-train) delivery of supplies and waste removal.

2-107
This pneumatic tube system gets rid of trash - at 80 m.p.h. Modern Hospital, 117(3):115, Sept. 1971.

A Joliet, Illinois hospital uses separate pneumatic tube systems to transport laundry and solid waste. An attendant bags the items, places the bags in the appropriate chute, and presses a button to activate the system. However, the high-speed tubes are not suitable for transporting glass. Furthermore, the bags must be durable and only partially filled or the bags will break and clog the tubes. Separate bagging of pathological, combustible, and noncombustible waste is recommended prior to placement in the tube.

2-108
Trash disposal systems at Georgia Hospital. Hospitals, 36(3):30, Feb. 1, 1962.

The provision in each utility room of two 55-gallon drums, one for flammables and one for nonflammables, lined with plastic bags for pickup by a closed vehicle minimizes the spread of dust-borne bacteria.

2-109
Vance, O. Plastic helps in the cleanup. Hospital Management, 92(2):48-49, Aug. 1961.

Studies show that the average general hospital produces almost one cubic foot or about seven pounds of solid waste/patient/day. Disposal is by incineration, burial on the premises, or trucking away. Plastic bag liners for waste cans resulted in labor and material savings which alone offset their cost. Other advantages of plastic liners are less noise, less wear on cans, and less frequent cleaning of cans. Cans are washed when required by appearance, and cans are sprayed with a phenol solution each time they are emptied. As a result, "our disposal areas are now cleaner and almost completely free of bacteria, rodents, and insects".

2-110
Vesley, D. and M. Brosk. Environmental implications in the control of hospital acquired infections. Nursing Outlook, 9(12):742-745, Dec. 1961.

Contaminated refuse can disseminate into the air any infectious agents contained in the refuse. The transfer of solid wastes to waste chutes is a potential source of environmental contamination; furthermore, pathogens can move vertically through the chutes. Careless handling of refuse can increase contamination greatly, so the authors recommend enclosing wastes in bags.

2-111
Vestal, A.J. Disposing of hospital wastes. Hospital Management, 73(6): 110-112, June 1952.

The author outlined a conventional waste collection system using fabric bags, typified by Denver's General Rose Memorial Hospital. The need to avoid air contamination is recognized, and sorting for salvage is considered a "must". The hospital burned some combustibles, and the city hauled away kitchen wastes and noncombustible items.

2-112
Vestal, A.J. Paper refuse sack system improves hospital's waste disposal system. Hospital Topics, 46(12):43-45, Dec. 1968. [1265, Hospital Abstracts, 9(8), 1969].

At St. Agnes Hospital, Fresno, Calif., disposable paper sacks are used for wet and dry refuse. When filled, a sack is simply rolled closed for a tight, litter-proof and odour-proof closure and is ready for incineration. The new system, which replaces plastic bags has reduced bag costs by 25 percent and bag storage by 50 percent. The bags are completely enclosed in holders of three types: (i) push-top holder operated with one hand; (ii) a drop-lid holder with a flat lid that closes automatically on release; and (iii) an open-top holder for use when both hands may be full. For collecting waste from patients' rooms, wall-mounted refuse sack holders have been fitted to the cleaners' trolleys. Two types of sack are used, a 70 pound kraft bag with a polyethylene lining for wet refuse and a two-ply 50 pound wet strength kraft bag for dry refuse.

2-113
Vincent, C. Trash collection system uses portable truck, plastic bags. Hospitals, 33(18):86-87, Sept. 1959.

Infection spread by trash can be a definite hazard to collection personnel and patients. The more flexible and vapor-proof plastic can liners are preferable to paper bags, and can also be used to line cloth bags. One hospital reused plastic bags except when torn or used for garbage, other wet wastes, operating room wastes, or laboratory wastes. Cloth bags are laundered monthly or more frequently, if soiled. Attempts to use the plastic bags without the cloth bags have been successful, but require instructing personnel in how to keep the plastic from breaking.

2-114
Vincent, C.L. Package trash in plastic bags for safe and sanitary disposal. Modern Sanitation and Building Maintenance, 11:22-23, May 1959.

An analysis of solid waste collection in the hospital is important to reduce cross contamination and costs. In addition to reducing costs,the use of plastic bags as liners for the standard 32 gallon waste can reduces the possibility of dust and bacteria dissemination, elevator and corridor traffic, as well as noise and odor. Liners help improve both job safety and job satisfaction while cutting labor costs.

2-115
Waste disposal in hospitals. Hospitals and Health Services Purchasing (London), 378-379+, Nov. 1972. [242, Hospital Abstracts, 13(2), 1973].

The four short papers in this feature are devoted to: (i) the disposal of human waste in hospitals; (ii) shredding and compaction of hospital waste; (iii) matching method of disposal to type of waste; and (iv) incineration.

2-116
Waste problem: Colorado State Hospital, Pueblo. Building Maintenance and Modernization, 16:22, Jan. 1969.

The hospital converted to a paper bag solid waste storage system which is claimed to be more aesthetically pleasing and more economical than metal containers. The system combines the use of dumpsters and the refuse sack system with landfill disposal for solids and incineration for contaminated materials.

2-117
Waste transport by suction--a hygienic improvement. Staedtehygiene (Uelzen/Hamburg), 19(12):4, Dec. 1968. [68-0172, Solid Waste Management, 1968].

Centralsug GmbH, Hamburg, West Germany, offers a new suction transport system for rubbish and other types of waste accumulating in hospitals, office buildings, and apartment houses. Transport by suction has been introduced in Sweden where such a system has been installed in hospitals. In Sundbyberg, a suburb of Stockholm, this transport system has come to replace waste disposal trucks. The transport of soiled laundry and wastes by suction requires less personnel than the common waste collection system by trucks. The systems operates automatically. Through a pipe system with valves in floors and walls, the waste can be sucked into the incinerator installed in the basement of a building (hospital, apartment house, etc.). The operating costs of the system are low since all exhausters operate only while something is transported.

2-118
Wickens, R.N. Cleaning procedures geared to infection control. Hospitals, 38(24):101-104, Dec. 1964.

Proper refuse disposal is important for infection control. Polyethylene bags are recommended for refuse, especially from infected areas. Containers for wet refuse and dressings should be sterilized after use. Polyethylene containers are preferred for most refuse because they won't corrode and are easier to clean and handle. Dry refuse should be placed in cotton bags which should be laundered after each use.

2-119
Winter, S. Consider the garbage can--keep it clean and keep it closed. Modern Nursing Home Administrator, 20(6):126, Nov.-Dec. 1966.

To facilitate work in the kitchen, disposal cans should be available where they are most needed. Properly constructed metal or plastic containers can be used. Plastic or paper bags, as can liners or on racks, are also acceptable. If collection fees are based on volume, a can crusher may be a worthwhile investment.

2-120
Wrap up your waste disposal problems in a paper bag. Modern Sanitation and Building Maintenance, 18(5):21-22, May 1966.

A New York City hospital used paper bags for waste collection. Steel bag holders were also used. A special paper was used which stretched and withstood rougher treatment than ordinary paper. Each bag held up to 83 lb. of refuse. The hospital had 75 beds, and daily use of 35 gal. bags was 75 to 100. Plastic refuse bags from patient rooms were placed in a paper bag on a mobile holder. Stationary bag holders were provided in utility rooms and outside isolation rooms.

SECTION III. TREATMENT AND DISPOSAL

3-001
Adams, H.S. How to cut waste disposal costs. Institutional Feeding and Housing, 10:120-123, Jan. 1958.

Cutting waste disposal costs in any institution first demands a careful study of the existing situation. The food service manager can plan menus that produce minimal garbage waste while considering labor and equipment costs for transporting garbage in cans. Garbage grinders can discharge some food waste directly to the sewer system. Incineration offers an on-site disposal method for combustible waste, but non-combustible waste still incurs additional costs for hauling from the premises.

3-002
Allen, J. Developing an environmental monitoring program. Executive Housekeeper, 18(6):26+, July 1971.

A bacteriological monitoring program at any hospital requires planning and work, but the effort pays off. Very low counts obtained by culturing the gas effluent from a hospital incinerator's chimney resulted from: (1) installation of a new incinerator operated according to strictly enforced procedures; and (2) double wrapping in both paper and plastic of all contaminated burnable solid waste from the laboratories.

3-003
American Public Works Association. Committee on Solid Wastes. Refuse Collection Practice. 3d ed. Chicago, Public Administration Service, 1966. 525 p. [66-0099, Solid Waste Management, 1966].

The data that served as the basis for this edition was obtained by means of a comprehensive survey conducted by the APWA in cooperation with the United States Public Health Service, which tabulated the replies to the questionnaire. The individual chapters cover the following subjects: definition of refuse materials; preparation of refuse for collection; collection costs; equipment; supplemental transportation; special refuse; municipal, contract, or private collection; financing; organization; personnel; equipment management; reporting, cost accounting and budgeting; and public relations. Appendices include excerpts from refuse collection ordinances and survey data and techniques. A selected bibliography is given for each chapter and a subject index is included.

3-004
American Public Works Association. Municipal Refuse Disposal. Chicago, Public Administration Service, 1961. 522 p.

Disposal at hospitals is complicated because the refuse has high garbage and moisture contents, with anatomical wastes being malodorous and possibly contaminated with pathogens. Flue-fed incinerators are not usually recommended for hospitals, and use of auxiliary fuel is essential. Prompt, thorough burning and minimum storage are most important. Hospital refuse does not burn readily, so close supervision is needed. Frequent agitation of refuse on the incinerator's fuel bed is also necessary. Hospitals often do not give their incinerators enough attention. Hospital incinerators cannot be designed for economic automatic operation, so an employee is needed for operation. Operating room wastes, experimental animals, and cadavers may be burned in a separate, specially designed incinerator. Such a unit should be designed for high temperatures, and perhaps with washers for the stack discharge.

3-005
American Public Works Association. Municipal Refuse Disposal. 2d ed. Chicago, Public Administration Service, 1966. 528 p. [66-0150, Solid Waste Management, 1966].

The objective of this manual is to review past and present disposal practices, principally in the United States; to gather pertinent data, bearing in mind geographic and seasonal differences; describe and analyze the best current practices; broadly indicate the costs; and discuss administrative and management problems. Individual chapters deal with: waste analysis, composition of refuse, selection of disposal methods, sanitary landfills, central incineration, on-site incineration, grinding of food wastes, feeding of food wastes to swine, composting, salvage and reclamation and refuse disposal management. Eight appendixes present: tentative methods of analysis of refuse and compost, ordinance provisions for refuse disposal, full wording of two such ordinances, standards of the Incinerator Institute for design of home incinerators, National Board of Fire Underwriters 1958 standards for installations of domestic incinerators, the Solid Waste Disposal Act, and the rules and regulations pertaining to grants for solid waste disposal projects.

3-006
American Public Works Association. Municipal Refuse Disposal. 3rd. ed. Chicago, Public Administration Service, 1970. 538 p. [Abstracts, Excerpts and Reviews, Vol. IV, 1971].

The objective of this book or manual "is to review past and present disposal practices, principally in the United States; gather pertinent data, bearing in mind geographic and seasonal differences; describe and analyze the best current practices; broadly indicate the costs, and discuss administrative and management problems." In short, to provide authoritative information for officials responsible for refuse disposal in local, state, and federal governments. In actuality, the book more than meets its objective. It is an excellent text for classroom use and a reference for one newly involved in matters of solid wastes management. Its weakest section is the chapter on salvage and reclamation. The chapter on composting is somewhat overly optimistic in tone and voices the increasingly unrealistic dream of the existence of a market for the compost product.

3-007
Anderson, J. and J.J. Beres. Collection and Disposal of Hospital Solid Wastes. M.S. Thesis. Rensselaer Polytechnic Institute, Troy, N.Y., 1970. 339 p. [12142, SWIRS].

The purpose of this study was to analyze present practices in hospitals with respect to solid waste handling and disposal and to propose a set of systems which could be applied to existing and future hospitals to alleviate problems which the hospitals now face and will face in the future. Included in the investigation were such areas as storage facilities; central supply; collection and disposal of rubbish, garbage, and special wastes; efficient use of personnel; and considerations of cross-infection. Personal investigations were made of eight hospitals. A questionnaire was sent to 24 other hospitals; of these, four questionnaires were returned. It was concluded that storage facilities were inadequate in all hospitals visited and that the incinerators were outdated and inadequate for their intended use. Recommendations for existing hospitals included the use of plastic liners for storage containers and incineration at temperatures of 1200-1800. Recommendations for a model hospital of the future included the use of a pneumatic chute system to convey wastes from patients' rooms and other areas to a grinder, and then to an incinerator. The use of garbage disposers was suggested for kitchen wastes. The data collected as a result of the hospital visit, questionnaire results, and definition of terms used in the thesis are collected in appendices.

3-008
Ashby, H. A problem - waste disposal. Hospital Administration, 5:31, Aug. 1957.

Garbage and waste disposal has been, and still is, a problem. Although various disposal methods have been tried, all methods still require a considerable amount of personal supervision to achieve satisfactory results.

3-009
Barbeito, M.S., L.A. Taylor, and R.W. Seiders. Microbiological evaluation of a large-volume air incinerator. Applied Microbiology, 16(3): 490-495, Mar. 1968. [68-0433, Solid Waste Management, 1968].

Two semi-portable metal incinerators, each with a capacity of 1,000 to 2,200 standard cu ft of air per minute, were constructed to sterilize infectious aerosols created for investigative work in a microbiological laboratory. Each unit has about the same air-handling capacity as a conventional air incinerator with a brick stack, but costs are about one-third. The units are unique in that the burner housing and combustion chamber are airtight and utilize a portion of the contaminated air stream to support combustion of fuel oil. Operation is continuous. Aerosols of liquid and dry suspensions of Bacillus subtilis var. niger spores and dry vegetative cells of Serratia marcescens were disseminated into the two incinerators to determine the conditions required for sterilization of contaminated air. With the latter organisms (concentration 2.03 times 10 to the seventh power cells per cu ft of air), a temperature of 525°F, measured at the firebox in front of the heat exchanger, was sufficient for sterilization. To sterilize 1.74 times 10 to the seventh power and 1.74 times 10 to the ninth power wet spores of B. subtilis per cu ft, the required temperature ranged from 525 to 675°F and varied with each incinerator. This was because of innate differences of fabrication, different spore concentrations, and the use of one or two burners. With dry B. subtilis spores (1.86 x 10 to the eight power per cu ft), a temperature of 700°F was required for sterilization. With dry spores, no difference was noted in the sterilization temperature for the two incinerators. The incinerator installation is illustrated. The incinerator was installed at a cost of approximately $40,000.

3-010
Barsoum, F. Kitchener Hospital tackles pollution. Hospital Administration in Canada (Don Mills, Ontario), 13(6):15, June 1971.

The engineer of a Canadian hospital reports efforts by his hospital to reduce air, water, noise and waves pollution. To reduce air pollution, the incinerator was upgraded and a new pathological incinerator was installed - both items at a cost of $8000.

3-011
Beghin, L. Unit trash compactors cut costs at Detroit hospital. Hospital Engineering Newsletter, 16(3):6, May-June 1971.

After a 1969 study indicated that Sinai Hospital of Detroit could save $3,000 annually by installing eight double-bag trash compactors, the hospital selected a pneumatic (rather than hydraulic or electric) compactor system. Despite extensive tubing requirements, the system is quiet, saves time, and eliminates unsightly on-site storage. The density of compacted materials might necessitate reducing incinerator capacity if incineration is the final disposal method.

3-012
Black, R.J. Solid waste handling. In Environmental Aspects of the Hospital. V.2. Supportive Departments. Public Health Service Publication No. 930-C-16. Washington, U.S. Government Printing Office, 1967. p. 20-27. [67-0088, Solid Waste Management, 1967].

In this guide for developing environmental control programs in the modern hospital, the responsibilities of supportive departments are given special attention. The principal types of solid wastes found in a hospital are: garbage, paper, trash, and other dry combustibles; treatment room wastes; surgery wastes; autopsy wastes; and noncombustibles such as cans and bottles. Average weight and volume of solid wastes have been estimated as between 7 and 8 1/2 lb and about 0.7 cu ft per patient per day. Adequate facilities for handling wastes include: waste chutes; waste rooms; on-site incineration; hauling for off-site disposal; waste containers and carts; garbage grinders; and storage rooms. Personnel performing collection, storage, and incineration work should be trained in protective techniques necessary for the proper handling of pathogenic wastes, medicines, empty containers with residual hydrocarbon products, and trash saturated with inflammable liquids.

3-013
Bohne, H. Air pollution damage from hospital incinerators. Staub (Duesseldorf), 27(10):451-453, Oct. 1967. [67-0488, Solid Waste Management, 1967].

The strong discoloration, whitening and eventual death of plants in two garden nurseries in the vicinity of hospital incinerators was shown to be caused by hydrogen chloride from the hospital refuse incineration plants. Chlorine compounds in the refuse consisting of 80-90% paper and packaging material were decomposed during short periods at a temperature of 800-1,000°C. Tabulated data show that the dust produced during the incineration is considerably higher in the flue and chimney than immediately after cyclone purification. Tables also provide information on the hydrochloric acid, the hydrofluoric acid and the sulfur dioxide content of the exhaust gas as well as the chlorine content of various packing materials. During incineration at temperatures upward to 900°C. and incineration starting at 900°C., most of the chlorine was given off, with the 900°C. preheated oven taking only 30-40 seconds. Erection of a chlorine washing plant attached to the incinerator is recommended.

3-014
Bohne, H. Hydrogen chloride emissions by incineration plants of hospitals. Staub (Dusseldorf), 30(8):337-339, Aug. 1970. [11716, SWIRS].

The severe damage sustained by two nurseries, which was previously reported, led to the investigation of the formation of HCl in hospital incineration plants. Samples of dust from 18 hospital incinerators were taken from ash pits, cyclone dust separators, flues, and chimneys and the chlorine content was determined. Results indicate that, in all cases, the chlorine content was much higher in the chimney than at the other locations and was lowest in the ash pit. To determine the variation with time of the HCl content of incinerator waste gases, two series of tests were carried out using a furnace of 800 liter charging capacity and an incineration rate of 100 kg/hr of refuse. In one series, 8 kg of refuse were charged every 5 min in another, 24 kg every 15 min. The HCl content, in mg/normal cu m of the waste gases was measured at 2 min and 5 min intervals as well as at the end of either test series. Results show that in both series the values measured at 2 min intervals fluctuate more widely than the 5 min ones and that many exceed the respective long term values. The formation of HCl in the waste gas was shown to be independent of the type of charging routine and to depend solely on the composition of the refuse. Results of measurements made 2.5 min intervals at a hospital incinerator of 1200 liter capacity with an incineration rate of about 150 kg/hr of refuse, confirm these findings. The occurrence of high short-term HCl contents which can be injurious to vegetation suggests that sole reliance on permissible long-term values is improper in assessing the validity of claims of damage to vegetation by waste gases.

3-015

Bowerman, F.R. Incineration. In Salkowski, M.D., ed. Disposal of Single-Use Items from Health Care Facilities; Report of the Second National Conference, September 23 and 24, 1970. Monograph No. 8. Ann Arbor, National Sanitation Foundation, Sept. 1970. p. 17-18. [15533, SWIRS].

Incineration is one of the most reliable methods of eliminating the waste material from disposables, especially since the institution involved - the hospital in this case - can exert a good deal of control over the disposal process. The major advantages of incineration include the following: the process produces a sterile ash which can easily and safely be handled through ordinary public disposal systems; the bulk is reduced to 5 to 10 percent of the original volume; it is rapid and treats wastes soon after generation; and the hospital retains control of its waste throughout the disposal process when dangers to the public may exist. However, the more noteworthy disadvantages of incineration are the generation of air pollution and the relatively high cost of equipment installation, maintenance, and operation. Despite its problems, though, incineration is likely to remain the treatment of choice for hospitals, particularly since improved designs may utilize the wastes as fuel to produce steam for heating and other needs of the institution.

3-016
Brady, P. New England Deaconess pioneers in 'Atomic Age' building code. Hospital Management, 72(5):116-120, Nov. 1951.

Some radioactive solid wastes may be disposed of by incineration. Although some other wastes may be held "for a period of a month or so" to allow decay to an acceptable level of radioactivity, the longer half-life of radium makes its disposal more difficult.

3-017
Briose, G.L. Incineration of hospital refuse. Nuova Tecnica Ospedaliera (Milan), 6:231-233, June 1963. [1034, Hospital Abstracts, 4(7), 1964].

This paper deals with the storage and disposal "on the spot" of refuse from blocks of flats and other large buildings. The use of refuse chutes and other systems of leaving refuse exposed during storage, while awaiting collection and disposal, is associated with foul odours, attraction of rodents and other hygienic drawbacks; the use of refuse collecting vehicles adds to the traffic problems in a town. The advantages to be gained are obvious when offensive refuse has not to be carried through the streets. Hospital refuse may carry infection and spread of this is avoided when incineration can be carried out within the hospital grounds. Refuse incinerator standards have been laid down in the United States. There must be no emanation of smell or other nuisances from the chimney, and the emission of smoke must be controlled so that it remains below 2 of the Rigelmann scale. Smoke deposit must not exceed the limits laid down by the local authority. The combustion chamber must be adequate in size to deal with the whole of one day's output of refuse, which can be calculated at two to three litres per hospital inmate. Before reaching the chimney the smoke must be led through a grit chamber at a rate of flow not exceeding two meters per second. Adequate smoke washing arrangements and safety valves must be provided. The incinerator has to be lined with refractories to an approved standard and exposed surfaces with which workmen are liable to come in contact should not become hotter than a temperature of 30°C.

3-018
British hospital studies use of disposables. Modern Hospital, 101(5): 106-109+, Nov. 1963.

Somewhat higher costs and disposal of disposables are two problems recognized by a small British hospital that conducted an intensive study of 170 different disposable items. Each type of waste was placed in a color-coded sack, and special containers were located near the waste sources. The study tested a small ward disposal unit that shreds papier-mache bedpans, urinals, and their contents, then flushes them away in a 1/120 water suspension. Small electric and gas incinerators were located on the wards for on-site reduction of waste volume, and a new gas-fired incinerator was installed to process wastes that could not be handled on the wards. The disposal method is one of five critical considerations when instituting a disposable product program.

3-019
Brown, R.M., ed. Use and Disposal of Single-Use Items in Health Care Facilities. Monograph No. 6. Ann Arbor, National Sanitation Foundation, 1969. 64 p. [7544, SWIRS].

The National Sanitation Foundation held its National Conference in Ann Arbor, Michigan of 1968 with financial support from industry and the Department of Health, Education, and Welfare on the use and disposal of single-use items in health care facilities. Representatives of the U.S. Public Health Service joined to share knowledge and effort in addressing the problem, as well as representatives of the Solid Wastes Program of USPHS. Problems as well as advantages offered by the use of single-use items are discussed. A major problem is one of how best to dispose of single-use products at minimal cost. Manufacturers recognize that their product responsibility must include the facility and cost of disposal as well as the cost of presenting a safe and optimally functional product from a basic use standpoint. Single-use items are an important institutional factor, will remain so, and are likely to increase in weight, volume, numbers, and usage. Hazards associated with attempted processing and reuse of disposable items should be carefully defined and effective warning notice given. Under certain conditions, it may be hazardous to the patient to use a reprocessed disposable. Various subjects are covered in the papers delivered by various authors.

3-020
Burns, P.,and H. Parker. Precautions are necessary when radioactive iodine or gold is used. American Journal of Nursing, 56(11):1404-1406, Nov. 1956.

Sometimes items such as paper wipes or dressings may be incinerated, even if radioactively contaminated. Books contaminated by the patient may be incinerated or stored in lead containers until the radioactivity is satisfactorily reduced.

3-021
Caliely, A.G., and C.F. Forster. Plastic waste and its disposal. Hospital International (London), 6:23, Dec. 1972.

"A disposable article is one whose disposal is someone else's problem, and since one of the desirable properties of plastics is their long-term stability, 'disposable' is a blatant misnomer." Yet the use of disposables in hospitals is encouraged to reduce the risks of cross-infection. Besides increasing waste volume, disposable plastics can cause problems at the sanitary landfill because of their low density. Unless reduced in volume mechanically, which increases disposal cost, the plastic material may not settle and become firm, thus making the site "unsuitable for any future load-bearing use". Biological treatment is of little use. Incineration is the recommended method of disposal, although certain plastics such as polyvinylchloride produce corrosive and polluting materials when burned. The author suggests autoclaving disposables to protect refuse handlers from any pathogenic bacteria.

3-022
Canadian study shows that it's cheap and safe to burn and dispose of infectious wastes at the hospital. Modern Hospital, 119(3):53, Sept. 1972.

A study by eight hospitals ranging in size from 59 to 900 beds and disposing of wastes by landfill found that on-site incineration of all hospital wastes costs only $0.89 per cubic yard compared to $2.68 per cubic yard at a centralized incinerator for several hospitals. On-site incineration also offered a slight savings in capital cost. The article discusses the volume and composition of waste from the subject hospitals, noting that on-site incineration is the favored disposal method because it destroys pathogens and greatly reduces waste volume.

3-023
A Cincinnati hospital tries out truck compactor. Hospital Engineering Newsletter, 17(6):2-3, Nov.-Dec. 1972.

Because their incinerator could not comply with air pollution codes, Christ Hospital decided to purchase a truck compactor for a capital investment of $25,000, instead of a new incinerator which still might not meet the standards, or a small compactor with a leased hauling service for $15,000 a year. Operating costs are roughly equivalent to those of the old incinerator.

3-024
Combs, W.H., and S.N. Craig. Waste disposal methods - part I - pulping. Modern Sanitation and Building Maintenance, 17(9):15-17, Sept. 1965. [65-0318, Solid Waste Management, 1965].

Incineration is the most used method of disposal but it only gives 95 percent reduction in volume of loose non-compacted burnable material. Incineration contributes to air pollution. Balers require labor to segregate materials since baling implies sale of accepted salvage. By using a hogger or shredder and blower with a baler, an automated system can be developed, but this proves undesirable if high dust and noise levels are a problem. Also, metal separation must be nearly 100 percent to avoid the hazard of dust explosion. Garbage grinders are excellent for food wastes, providing silverware and paper is kept out of the meshing parts. The pulping system consists of two parts: a pulper and a waste extractor recirculator. The pulping unit is basically a tank with rotating impeller, recessed below the contour of the tank itself making it non jamming. A row of cutters permits tearing of nonpulpables, which are mixed with general wastes. As it is chewed small enough to pass through the screen, it is pumped as a slurry of 2 percent solids to the water extractor. Heavy nonpulpables are separated by a combination of centrifugal force and gravity and settle in an opening in the bottom of the tank and emptied. Material in for the form of slurry is pumped to the Hydra-extractor. The material is squeezed to remove additional water. The system provides an 80 percent reduction in volume.

3-025
Community Systems Foundation. A Disposable Product Distribution Model for Hospitals. Ann Arbor, Community Systems Foundation, June 1964. 27 p. [PU3008, Abstracts of Hospital Management Studies, Vol. II, 1966].

Based on a philosophy of direct supply flow from stores to nursing unit, the model (essentially descriptive) identifies and evaluates expected variables between hospitals, and measures the importance of alternative policies and operating procedures associated with the flow of material and paperwork within the system. Principal variables are consumption rate and available storage space. Particular attention given to packaging specifications, handling method in general stores, transportation to nursing units, storage at the nursing unit, disposing of used items, flow of paperwork, control cards, patient charging, and stock distribution records.

3-026
Cooper, T. The effect of installation of garbage grinders on sewage treatment at Elgin State Hospital, Illinois. Public Works, 85(4):110, Apr. 1954. [122, Refuse Collection and Disposal, 1954-1955].

Seventy-five percent of all garbage is ground and discharged into the institution's sewers. In general, the grinder installations have increased the biological load on the activated sludge-type of treatment plant from 45 to 55 percent. Total BOD reduction through the plant is 96.6 percent. Principal disadvantage from addition of garbage is the substantial "biologic" increase above what was already peak flow. "Before" and "after" statistics show increases of 60 percent in raw sludge, 63 percent in volatile solids, 60 percent in gas production, 34 percent in BOD of raw sewage, while sewage volume remained essentially the same.

3-027
Cooper, W.T. A Study of Solid Waste Disposal, Research Hospital and Medical Center, Kansas City, Missouri. M.H.A. Thesis. Baylor University, Waco, Texas, August 1970. 96 p. [HU2-5997, Abstracts of Hospital Management Studies, Vol. VII, 1971].

A study to determine the best method of solid waste disposal for Research Hospital and Medical Center, Kansas City, Missouri. Examination was made of the present system, and the type, volume and weight of daily waste were determined. Four systems of waste disposal were evaluated by cost/benefit analysis and adherence to air pollution codes. Author recommends a system combining a pulping unit for disposal of pulpable waste, a crusher-destroyer unit for bulk reduction of nonpulpable waste and the use of the present incinerator for disposal of pathological wastes and for use in emergencies. Various pulping units and crusher-destroyers are also evaluated.

3-028

Corey, R.C. Incineration of radioactively contaminated combustible wastes. In Principles and Practices of Incineration. New York, Wiley-Interscience, 1969. p. 239-253. [12998, SWIRS].

The incineration of combustible radioactively contaminated solid wastes may be employed unless unlimited burial or storage facilities are available to off-site facilities or unless it is convenient to transport the wastes to storage depots. Because of the wide variations in the characteristics of the wastes, the incinerator must be carefully selected to achieve two results: maximum combustion efficiency, with only negligible quantities of smoke, tars, malodorous gases, and/or vapors discharged to the atmosphere; maximum retention of solids within the system, with a minimum amount of particulate matter entrained in the flue gases. Incinerators designed specifically for off-site wastes are not available commercially at the present time, although some experimental work has been done to adapt conventional incinerators to off-site requirements. A brief review of research related to the incineration of contaminated wastes is provided. An efficient solid-fuel-boiler plant, furnishing heat and power to an institution or other user of radioisotopes, offers possible means for contaminated waste disposal. If a boiler furnace is to be used for contaminated-waste disposal, the following factors should be considered: safe handling of the waste in the plant; safe charging the packaged wastes to the furnace; scheduling the charging to avoid feeding large charges in a short time; and monitoring the stack gases and areas where residues are collected. The need for removing particulate matter from the products of combustion depends mainly on the amount of radioactivity charged to the incinerator.

3-029

Davies, E.M. Disposal of hospital waste. Hospital Engineer (London), 23(10):225-232, Oct. 1969. [267, Hospital Abstracts, 10(2), 1970].

In 1966/67 the Ministry of Health conducted a survey which has produced useful information about the loads of and relationships between different types of hospital waste. These have been classified into: (i) ward waste; (ii) plastic materials and dirty paper; (iii) theatre and laboratory waste; (iv) maternity waste; (v) kitchen waste; and (vi) clean paper. Methods of disposal of waste fall into three categories: local authority, incineration,or maceration. The author considers each of these in turn. Refuse removed by local authorities from hospitals falls mainly into the category of house refuse, although some might be considered trade refuse. The standards for incinerators, their siting and installation, fuels, requirements of the Clean Air Act and the collection, transport and incineration of waste are described and seven photographs of incinerators are given. Several macerators are illustrated. These are used for the destruction of disposable bedpans and pathological waste.

3-030
Davies, E.M. Hospital refuse disposal. Hospital & Health Services Purchasing (London), 11:383-384, Nov. 1972.

The burgeoning volume of hospital wastes, particularly the result of disposables and their packaging, demands that engineers consider various waste disposal methods, particularly on-site treatment by incinerators, macerators, shredders, and compactors. Choosing the "best" method depends on the type of waste, site location, local environment, fuel, power, and water availability. The author lists hospital waste as categorized by Britain's Department of Health, as well as appropriate disposal methods for each category. However, local conditions must dictate the final selection of the disposal method. The article discusses the requirements of a disposal facility; instructions for the efficient, safe, and nuisance-free operation of a disposal plant; personnel training; as well as guidelines for collection, storage, spillage, and plant cleaning.

3-031
Davies, E.M. Incinerators: some of the latest items from the ranges of prominent manufacturers. Hospital Building and Engineering (London), 3(4):8-10, July 1970.

The author states that incineration is the "most acceptable" means of waste disposal. The 1956/68 Clean Air Act has led to better incinerator design. The British Standards Specifications, currently being revised, provide basic standards for operation and safety as well as determining capacity. A well trained operator is necessary to provide efficient and nuisance-free operation. Twelve manufacturers provide descriptions of incinerators for general hospital refuse and pathological waste.

3-032
Decker, W. Managing hospital and institutional wastes. In Proceedings of the Governor's Conference on Solid Waste Management, Hershey, Pennsylvania, October 8-9, 1968. Harrisburg, Department of Health, Bureau of Housing and Environmental Control, 1968. p. 150-154. [6248, SWIRS].

The total waste generated per patient bed is 12 lbs/day. The use of disposable materials has caused a sharp increase in waste generation. Wet waste now represents only 30% of the total while the volume of paper and plastic is increasing at a fast rate. The heating value of the waste has increased to 7,000 BTU's. The most common disposal method at this time is the incinerator. Plastics and aerosol cans have been the major cause of incinerator problems. Medical waste incinerators are specifically designed to handle pathogenic waste at high temperatures. Waste handling techniques must be taught to hospital personnel to ensure safe and efficient methods of waste disposal. Special equipment has been designed to handle syringes. Pulping systems are used for general waste and food service waste. The ideal approach is to locate the pulper at the point of waste generation and the dewatering device at the point of waste removal and thus, by means of a closed loop, transport the waste by pipeline through the building.

3-033
DeMarco, J. et. al. Incinerator Guidelines -- 1969. Cincinnati, Public Health Service, Bureau of Solid Waste Management, 1969. 176 p. [7327, SWIRS].

The guidelines were conceived as a method of describing the best in current incinerator technology. In the absence of firm technical data, the guidelines describe desirable performance characteristics for present day incinerators, the process of incineration, and the "state of the art". The text is divided into the following sections: Incineration: a volume reduction process; Basic data for design; Incinerator costs; Site selection, plant layout, and building design; Utilities; Weighing; Receiving and handling solid waste; Furnaces and appurtenances; Recovery and utilization of heat; Instrumentation and controls; Incinerator effluents and their control; Air pollution control; Acceptance evaluation; Solid wastes that require special consideration; Salvage; Operation and maintenance. The appendices include an accounting system for incinerator operations and a copy of Executive Order 11282, Control of Air Pollution Originating from Federal Installations.

3-034
Deming, E.C. How to remove waste to remove hazards. Modern Hospital, 91:130-136, Oct. 1958.

The general hospital produces seven types of waste: ordinary floor refuse; kitchen waste; pathological refuse; wastes from x-ray and plaster rooms; shipping refuse; metal wastes; and glass. These wastes can be disposed of by incineration or other on-site disposal, trucked away, or a combination of the two, possibly with a planned salvage program. Because of its advantages, the author details incineration and the three types of incinerators used in modern hospitals: the flue-fed unit, the natural draft incinerator, and the high temperature incinerator especially useful for pathological and laboratory wastes. In addition to the final disposal method, care must be paid to in-hospital collection methods and maintenance of waste receptacles. The author describes the seven types of waste and attendant disposal hazards, telling how to collect and dispose of each type of waste.

3-035
Derringer, R. Environmental case for reusable linens. Health Institution Purchasing, 3:19-20, Dec. 1972.

Because linen and waste are respectively the second and third highest volumes of weight moved in a hospital every day, the author recommends that hospitals carefully evaluate waste disposal systems when considering conversion to disposable linen supplies. Environmental pollution and disposal costs for disposable linens, as well as additional space and labor requirements, suggests that a linen service (featuring multi-purpose linen items) might be preferable to disposable linens.

3-036
Disposables. British Hospital Journal and Social Service Review (London), 81(4257):2425+, Nov. 20, 1971. [391, Hospital Abstracts, 12(3), 1972].

The five short papers in this feature are on: (i) the quality of cleanness; (ii) the pros and cons of using disposables; (iii) effects of their use on long-range planning; (iv) non-woven fabrics; and (v) plastic waste and its disposal.

3-037
Disposables digest: disposal study. Disposable Soft Goods, p. 30-31, Dec. 1970.

A recent survey of paper food service disposables by the Plate, Cup, and Container Institute, Inc. found that a hospital kitchen feeding 200 patients on disposable dishware produced only 100 pounds of extra waste a day and, with disposable trays, 250 pounds a day. All waste from 200 meals was incinerated in 30-40 minutes. Cost ranges for small incinerators (100-500 lb/hr capacity) are from $3000-$9000. For 1000-1500 lb/hr capacity, the cost ranges from $12,000 to $22,000. Pulpers are recommended especially if more than 300 meals are served at a time. Cost ranges for small stainless steel pulpers (100-400 lb/hr capacity) are from $7500 to $10,000. For 500-600 lb/hr capacity, the cost ranges from $18,000 to $30,000.

3-038
Disposables dilemma: how to dispose of them. American Hospital Professional, 5:5, Oct. 1969.

To illustrate the increasing desirability and consequent waste volume of disposables, the article focuses on Boston's New England Deaconess Hospital. That hospital has introduced many disposable products, most recently a disposable bedside care unit weighing two pounds (rather than the 15 pounds of the conventional stainless steel equipment). However, disposables require more storage space, a tighter delivery schedule of new products, and more frequent haulage of the compacted waste. Ultimate disposal remains a critical problem, especially since disposables are here to stay.

3-039
Disposables for food service. Instelling-Management (Den Haag), 4(3): 112-113+, Mar. 1972. [831, Hospital Abstracts, 12(6), 1972].

Before a decision is taken to introduce disposable plastic tableware careful consideration should be given to the economic aspects. Some of the other advantages of disposable crockery and cutlery are saving of labour, reduced infection risks, savings on breakages, and noise reduction. Regard should also be had to the reaction of patients. An enquiry in a cafeteria where disposable tableware was tried out for a limited period showed that 25 per cent of customers approved and 47 per cent disapproved of disposable plates and cutlery, while 73 per cent approved and 12 per cent disapproved of disposable cups and glasses. Used disposables can be disposed of in three ways: as unprocessed waste; as processed waste (e.g. after treatment in a pressing machine); or by incineration. The latter is considered to be the best method. A table lists the items of disposable tableware obtainable from 26 firms in the Netherlands.

3-040
Disposal methods inadequate for disposables, N.S.F. told. Modern Hospital, 115(5):30-32, Nov. 1970.

The disposal dilemma faced by hospitals using more and more disposables becomes increasingly complex as air pollution standards, sanitary regulations, and sewer capacities of individual communities further restrict disposal by incineration, landfill, and wet-grinding. A conference at the University of Michigan discussed these problems. At the conference's conclusion, the National Sanitation Foundation called for "research studies, more manpower, definitions of the variety of solid wastes, a dialogue between all interested agencies, and recycling of wastes". In this role of expanded responsibility, the N.S.F. recommended that it work with industry to develop products easier to destroy or recycle and that the American Hospital Association and American Public Health Association "get involved in the solid waste problem".

3-041
Disposal of medical isotope waste is easily solved problem at National Institutes of Health. Scope Weekly, 4(8):7, Feb. 1959.

"Compared with radioactive waste from the production of nuclear energy, the quantities of medical isotopes to be disposed of seem tiny." However, concern developed over medical isotope wastes which may be most frequently discharged directly into the environment, via the sewer system. Most disposal problems result from activity originally present as I-131, P-32, and Au-198. Eleven months of shipments from Oak Ridge in 1957 totaled 1500 curies of these three radioisotopes. However, all three have short half-lives. NIH incinerates or buries some radioactive wastes. Some solid wastes, such as animal carcasses, are sealed in concrete at NIH, then dropped into the ocean for disposal.

3-042
Disposal of radioactive waste. British Medical Journal (London), 2:295-296, Aug. 29, 1959.

Although trained staff handle radioactive wastes from power generating and fuel processing plants under adequate legislative control, many other places such as industries and hospitals using radioactive materials are less adequately controlled. More than 90% of the radioactivity used in industry and hospitals is from closed sources, each of which may "constitute a highly active waste" after decaying to a level too low for its purpose. Normally open sources used in research and hospitals produce relatively inactive waste. Disposal of "millicurie amounts" of solid wastes in refuse receptacles is considered relatively safe.

3-043
Dispose of your waste problems. Institutions, 56(3):88-92+, Mar. 1965.

This article summarizes a general survey made of disposal units for institutions including grinders, bottle and can crushers, and pulping devices.

3-044
Disposing of disposables. Hospitals, 43(21):78+, Nov. 1969.
[751, Hospital Abstracts, 10(5), 1970].

According to a recent report by the Plate, Cup and Container Institute, New York, there are three main reasons for the increased concern over the problem of waste disposal: (i) laws on pollution have been strengthened; (ii) the amount of waste is increasing; and (iii) higher transport charges are making it necessary for waste to be processed before it is transported. Three waste processing techniques, incineration, pulping and compaction, are discussed. Incineration is the most popular means of processing, providing as it does the greatest reduction in volume and weight. Closed-system pulping is of increasing interest to engineers because when the grinding units are at the point where waste is generated and the extractors are in a remote discharged area, the transport of waste within the hospital is completely eliminated. The disadvantage of this system is that there are a large number of materials which it cannot handle. Compactors are the least expensive and simplest method of processing but as yet are very little used. Some concern has been expressed on the possible sanitation and contamination problems of this system.

3-045
Disposing of disposables. Southern Hospitals, 39(1):13, Jan. 1971.

Providence Hospital, Washington, D.C., with 350 beds used to segregate trash into types with about one half incinerated on-site by four men and the other half hauled away. Now trash is collected in plastic bags, then dropped into a chute delivering the bag to an automatic compactor. Compacted waste passes through a delivery pipe and a paper bag at the end receives the compacted trash. The filled sack is set aside and later fed into the incinerator. Now one man burns all waste in 6 hours a day. Projecting labor savings at wage rates of $2/hour direct labor cost would be reduced from $34,944 to $4,368 and at $2.5/hour, from $43,680 to $5,460 per year.

3-046
Disposing of disposables: refuse compactor. Hospital Administration in Canada (Don Mills, Ontario), 12(11):21-22, Nov. 1970.

Disposables in hospitals are here to stay, adding increased volume (now 15-20 lbs/patient/day) and increased air pollution to the hospital solid waste problem. The article describes the operation of a large outside refuse compactor which is claimed to be efficient and economical, without adding to air pollution problems. Testimonies from two Canadian hospitals (one formerly used on-site incineration and the other contracted for haulage of uncompacted refuse) support these claims.

3-047
Disposing of wastes. Modern Hospital, 87(2):12. Aug. 1956.

A southern California hospital installed a heavy-duty, commercial food disposer unit powered by a 3/4 h.p. motor outside the surgical suite to receive both maternity and surgical waste tissues. The unit grinds the tissue "through an opening that has a tolerance of 5/1000 to 8/100 inch before it goes into the scavenger bowl and then into the waste line under pressure". This method replaces the more expensive former method of freezing, then hauling the biological wastes.

3-048
Disposition of disposable syringes. American Journal of Public Health, 55(3):468-469, Mar. 1965.

The findings, progress, and recommendations of the APHA Subcommittee on Disposable Syringes of the Committee on Evaluation and Standards indicates that the improper disposal of disposable syringes and other medical supplies poses a potentially serious public health hazard. Few states and municipalities have regulations regarding possession or disposal of hypodermic syringes/needles, yet a legal authority said that "legal liability for the disposal of single-use hypodermic syringes...

is covered under the general legal provision that a person using a piece of equipment of this type is responsible for its final disposition". The committee recommends three disposal methods (breaking, crushing, and incineration) and mentions manufacturers of devices for destroying syringes. Public and professional concern for disposal of single-use equipment and supplies will help avoid serious incidents or misuses of that equipment.

3-049
District of Columbia. Hospital solid waste management. In District of Columbia Solid Waste Management Plan. Status Report 1970. Washington, U.S. Government Printing Office, 1971. p. 11-15. [16164, SWIRS].

Hospital wastes present unique hazards to those who handle them and to the environment. Wastes were analyzed at 12 of the 17 hospitals in the District. Solid waste was generated at a rate of 11 lb per patient per day, not including garbage put into the sewer system and pathological and infectious materials which are incinerated. Most of the solid waste generated is incinerated on-site. Three hospitals use compaction. Most are using plastic refuse container liners. Both professional and subprofessional help showed inadequate knowledge of hazardous wastes handling techniques, and in-house regulations are usually lacking. Training and effective regulations are needed. Compactors, heavy duty plastic bags, and food waste grinders should be more widely used. Existing incinerators should be replaced or modified.

3-050
Dmytryck, P. Analysis of Trash Removal System. Ann Arbor, Community Systems Foundation, 1970. 8 p. [HU2-7404, Abstracts of Hospital Management Studies, Vol. VIII, 1972].

Study of trash removal system from the main dining room in Waterbury Hospital to evaluate the economics of installing a portable compactor. Presently trash is removed by one employee working at a "pass thru window". Trays are not turned in at a constant rate, so he is available to perform other tasks. It was estimated that the net savings of the compactor would be 44.75 minutes/day. Because of the intermittent nature of the work and since the savings would be distributed over two shifts, it is not recommended that a compactor be purchased.

3-051
Donovan, J. Disposables. Occupational Health (London), 18:38-39, Jan-Feb, 1966.

Disposing of disposables is a problem which confronts the hospital and occupational health departments. Generally on-site incineration is considered the most suitable method of disposal for the waste materials classified as obnoxious while the remainder can be removed for disposal with other general material. Paper sacks offer great advantage for the containment of waste material, in addition to reducing infection.

3-052
Dornette, W.H.L., and D.P. Yuellig. Disposables and the combustible load in hospitals. Fire Journal, 66:27-30, July 1972.

Few hospitals have adequate storage facilities to store the volume of disposable items currently in use or trash disposal methods which safely remove the used items and their packaging. Yet these products are highly combustible and produce irritating and toxic products when burned. An extensive table lists 36 disposable items, their composition, and the chemical elements and their possible products of combustion. Although the hospital cannot change product composition, the hospital can solve the storage problem by minimizing bulk and equipping storage areas with fire detection, containment, and suppression equipment. The authors discuss on-site waste collection and treatment, suggesting that waste be transported to the disposable point as frequently as necessary and that all trash-receiving facilities be equipped with automatic sprinklers. Because incineration contributes to air pollution, the authors recommend compaction and landfill burial for ultimate disposal.

3-053
Efficient incineration of hospital waste. Hospital Administration in Canada (Don Mills, Ontario), 4(11):30-31, Nov. 1962.

Even the most efficient means of disposal for hospital wastes, incineration, has problems. Hospital refuse has a low calorific value, but must be destroyed at high temperatures. Some European hospitals use a two-chamber vertical incinerator in order to obtain better combustion. Sputum incinerators also have a two-story design, with emissions required to pass a "second flame barrier". A "cremator" for destruction of amputated tissue uses flue gases to maintain high temperatures in an inner chamber. Selenium in wastes can produce odors at up to 1200°C. An incinerator has been designed to reduce the bulk of radioactive combustibles by seven-eighths. Special ash handling is provided, and emissions are washed.

3-054
Ehnes, E.H.,and H.G. Olson. Hospital helped design this waste incineration system. Modern Hospital, 105(5):152+, Nov. 1965. [1146, Hospital Abstracts, 6(7), 1966].

Cooperation between Hennepin County General Hospital, Minneapolis, and a local manufacturer resulted in the design and installation of a comprehensive incineration system. The specification called for a system which is: (i) safe; (ii) capable of accepting all hospital materials; (iii) automatically operated; (iv) fed by a remote loading mechanism; (v) operated under negative pressure so that burning materials and fly ash cannot escape; (vi) designed for convenient withdrawal of the residue, which must be sterile; (vii) odourless; and (viii) provided with adequate space for collected refuse. The system provided consists of a multiple-stage, gas incinerator that reduces all waste materials to a sterile residue. The first stage receives waste material and reduces the bulk of the refuse. Gases and fly ash from combustion are carried to the second stage where oxidation is completed. The exhaust air is subjected to a water scrubber which precipitates out any airborne particles. This precipitated residue is taken out through the normal sewage system. Fly ash and non-combustibles are removed at the end of each day's operations. The system has proved to be very effective in operation.

3-055
Elimination of hospital waste. Hospital Administration, 3:39, Nov. 1955.

"Hospital waste is dangerous waste because much of it is germ laden." While hospitals may take considerable precaution against many possibilities of infection, they seem to have "lapsed in vigilance" in waste handling. If a hospital lacks an incinerator, then refuse may be hauled away or put into a boiler furnace although the latter may interfere with boiler efficiency.

3-056
Engineering and maintenance comment: garbage grinders. Hospitals, 23(5):75, May 1949.

"City ordinances often will be the deciding factor if hospitals are to install garbage grinding disposal units." Grinders are prohibited in some cities because of grease, "operation difficulties", special instances of sewer clogging, and fear of additional water pollution.

3-057
Environmental considerations of solid waste. Hospitals, 46(9):88+, May 1, 1972.

The American Hospital Association and the Health Industries Association co-sponsored a seminar to determine how hospitals, particularly their solid wastes, affect the environment. Representatives of the federal government, waste disposal agencies or firms, and the paper, glass, metal, and plastic industries discussed the government's position (including predictions of more stringent air pollution standards and increased concern about "contaminated waste"), the composition of solid waste, and disposal methods. The summary statement by the seminar moderator notes a discrepancy between the seminar tone and reality, "If things are so good, why are they so bad?"

3-058
Environmental services. Hospitals, 45(7):61+, Apr. 1, 1971.

This is a review of articles relating to environmental services, those factors of hospital operation concerned with environmental health and safety. Solid waste from hospitals contributes to the contamination of the air, water, and soil. The increased use of disposables aggrevates the problem. All elements of solid waste management in the hospital should be subjected to a systematic analysis.

3-059
Exhibit for hospital equipment in Dortmund between May 19 and 22, 1965. Staedtehygiene (Uelzen/Hamburg), 16(5):125, May 1965. [65-0377, Solid Waste Management, 1965].

At the exhibit for hospital equipment the company Ruppmann, Stuttgart, West Germany, showed 3 types of waste incineration for hospitals; one with a capacity of approx. 0.2 m.^{3}/hr., one with approx. 0.75 m.^{3}/hr., and one for 0.5 m.^{3}/hr. The latter one can be used for incineration of standard hospital waste as well as for moist trash from the operating room. It has a furnace substructure for dustfree waste removal. The furnaces permit a sanitary incineration of plaster castings, kitchen wastes, disposable bed sheets, animal carcasses, tissues, etc. Prior to loading, the furnaces are heated up to the operating temperature by an oil or gas burner. To avoid odors the waste gases are led through an afterburner.

3-060
Facing the trash explosion. Building Operating Management, 17(10): 20+, Oct. 1970.

The innovative development of equipment for waste collection and final disposal allows tailoring the entire waste handling system to the needs and facilities of the individual building in accordance with increasingly stringent pollution control restrictions. The article briefly discusses modern internal collection equipment and methods such as on-site compaction, pulping system, chutes, and pneumatic tubes. In-depth discussion of incinerators covers two basic designs (the retort and the in-line), automatic charging, large incinerators, high temperature combustion of plastics, and particulate emission control with air scrubbers. An alternative disposal method that "avoids the problem of air pollution entirely" is the compactor, ranging from institutional size to small units appropriate for low volume use. Compactors, frequently used in conjunction with a chute or conveyor, also are useful for reducing waste volume at transfer stations before ultimate discharge at a landfill. Balers, a type of compactor, "have long been used to create bales of reuseable materials". "For situations where most waste is paper and/or food, pulping may prove to be a practical solution." However, which of these four disposal methods (either singly or in combination) affords the optimum waste disposal method will be dictated by variables of the individual building.

3-061
Farr, A.G.R. and H.B. Healy. The use of gas in hospitals and schools. Hospital Engineer (London), 19(3):65-74, Mar. 1965.

The authors regard incineration as one of the safest and most effective disposal methods for all kinds of hospital wastes, particularly infected material. After study, the British Standards Institute published two standards for hospital incinerators, one for small units and one for large units. Important considerations were (1) preventing the discharge of unburnt particles through the flue, assuring "complete combustion at temperatures which destroy all bacteria", and (2) avoiding air pollution. The British Standard preferred gas to electricity as "the most rapid and convenient source of heat for incinerator operation". Soiled dressings may be disposed of in small incinerators with capacities of 0.25 to 2.5 cu. ft. Because immediate destruction of infected combustibles (e.g., dressings, swabs, and sputum cups) is considered vital to minimize cross infection, the installation of small incinerators is recommended in or near medical or surgical wards to destroy small dressings. Trials at Acton Hospital showed the practicality of incinerating disposables in small ward incinerators when difficult materials (e.g., plastics and aluminum foil) comprised less than 33% of the load.

3-062
Fisher, W.C. A look at the use, procurement and safety of disposables in patient care. Hospital Management, 101(2):125+, Feb. 1966; 101(3): 117-120, Mar 1966. [1464, Hospital Abstracts, 6(9), 1966].

The author outlines the development of disposables. Today not only medical and surgical supplies, but also a wide variety of cleaning and linen materials are being replaced by disposables. Factors considered in selecting disposables include prevention of cross infection, use cost, comfort, convenience, and the quality of materials. Many duplicates of existing products are now becoming available; price alone should not be the criterion in selecting a particular item. The second part of the paper is particularly concerned with the safety of plastics used in therapeutic procedures. Their chemical, physical, biological and bacteriological testing are discussed. Disposables should be kept in a fairly fresh state and good stock control is essential. Stores should be properly ventilated and clean. Packaging should meet specified standards. Disposal is of major concern: there is no ideal method but burning, grinding and crushing are discussed. Particular care is needed in the handling of disposables. Their use will probably increase considerably in the next 10 to 15 years and their impact will cause changes in hospital design.

3-063
Fletcher, B.A. The Use of Individual Nursing Station Compactors as Part of a Hospital's Solid Waste Disposal System. M.S. Thesis. University of West Virginia, Morgantown, W.Va., 1971. 78 p. [Abstracts, Excerpts and Reviews, Vol. V, 1972].

A compactor could take the place of three to five refuse receptacles (32-gal garbage cans). It resulted in the improvement of the overall sanitary conditions of the utility room in that waste was kept covered and confined. The use of the compactor lessened the amount of time spent by personnel in handling the refuse. With the compactors there is no need to separate the refuse. The janitor merely loads the refuse on his cart and transports it to the loading dock to be hauled away. About 1,370 lb of refuse was produced each day in the patient care units. The system proposed in the paper would involve the use of 17 compactors, which would use an average of 24,280 bags per year. The projected annual cost of this system would be $12,250 or $0.07/patient-day. Larger machines would have to be used because the test machines were designed for residential use. The life expectancy of the test machines under hospital conditions would be only 2 years. The cost of the bag presently used in the compactor would be the biggest obstacle to be met in providing an economical system. It currently accounts for two-thirds of the cost of the system.

3-064
Foltz, W.M. Choosing an efficient waste disposal system. Hospitals, 43(3):67-68+, Feb. 1, 1969.

The author discusses the advantages and disadvantages of flue-fed incinerators, gravity chutes, compactors, pulpers, and hauling. Flue-fed incinerators should not be used because of fire hazards, air pollution, and the possibility that smoke could be diverted into the hospital. Problems with gravity chutes include the possibility of fires and backdrafts of contaminated air unless the chute is under negative pressure. Hauling to a municipal treatment facility without pretreatment can be expensive, yet this system is used more than any other. Compactors connected to a gravity chute will lessen manual handling of waste. Pulpers will reduce waste volume by 80% but they cannot handle all plastics, are expensive and require frequent maintenance.

3-065
Food waste disposers. Hospital and Nursing Home Food Management, 5:44, Apr. 1969.

The article includes a description of how a food waste disposer works as well as a chart to help in determining the size unit required for a particular installation. The disposer should be corrosion resistant, and a silver trapping device is recommended as an optional feature. Disposers are noisy and are not permitted in at least 54 communities, including about 20 large cities.

3-066
Foxall, C. Disposing of disposables. Occupational Health (London), 20:72-73, Mar-Apr. 1968.

The disposal of soiled disposable dressings creates a serious risk of cross infection. Although paper liners in dressing bins offer an improvement, handling is not eliminated. Immediate incineration of soiled dressings is ideal in theory, but installation of an incinerator in the operating room is relatively costly. A British unit originally designed for disposal of kitchen waste, is described. It is a polyethene sack attached to a metal holding unit and when full, the sack is hermetically sealed by an electrical device.

3-067
Franke, H. Report on the trial use of disposable crockery in a hospital. Krankenhaus Umschau (Kulmbach), 40(10):930-932, Oct. 1971. [538, Hospital Abstracts, 12(4), 1972].

In the 1,000-bed Katharinen Hospital, Stuttgart, all crockery is regularly washed by hand in the wards. In a six-week trial, 13 items of disposable polystyrene crockery were tested in five wards having a total of 160 beds; in one of the wards disposable cutlery was also used. Doctors, nurses and patients were satisfied with this crockery, hygiene was improved, noise reduced and labour and, probably, expense saved; only trifling disadvantages were encountered. It is planned to extend the trial to other wards. Experience has shown that the used crockery, packed in plastic sacks, is easily and harmlessly destroyed by incineration.

3-068
Freedman, M.A. Unknown usage trends create hazards in hospital design. Hospitals, 38(23):106-108, Dec. 1, 1964. [1005, Hospital Abstracts, 5(7), 1965].

A clear-cut formula for the calculation and use of disposables is impossible. The indivdual hospital's environment, staff, design, location and size will all modify any formula. Perhaps the greatest single factor that will affect hospital design is the disposal of used disposables. All the present methods have serious faults. The second most important problem is storage space. Consideration by manufacturers of this problem will increase acceptance of disposables by all concerned. In the prevention of infection there is little or nothing that disposables can provide that good technique will not provide with reusuables, but techniques used in hospitals are seldom equivalent to those which may be attained with disposables. Standards for commercial production are essential. Theoretically, to establish optimum infection control, everything should be disposable. There are economic limitations, but many items now regarded solely as reusables may become economically feasible as disposables. As a result, hospitals of the future may not need central supply, laundries, or dishwashing facilities. The need is for concentrated, well-controlled development programmes sponsored by groups of manufacturers to produce disposables better suited to the hospital's needs and purse.

3-069
Garbage by any other name must still be disposed of. Modern Hospital, 72(2):76-77, Feb. 1949.

A survey of garbage disposal methods in 24 small hospitals, ranging from 25-125 beds, revealed that the average institution today has a centralized garbage collection and dishwashing system, burns most of its garbage in a hospital incinerator and has the remainder picked up by the regular city garbage collection service. Fifteen of the hospitals used incineration to dispose of at least part of their waste. Garbage from 12 hospitals was picked up by the city while farmers picked up some of the garbage from 8 hospitals.

3-070
Garbage disposers provide superior sanitation. American City, 72:13, Aug. 1957.

Installation of food waste disposers in a Chicago veterans' hospital eliminated the need for garbage cans. Eleven of the fifteen disposers were installed in floor kitchens. A "silver guard" at each disposer reduced the loss of silverware with garbage.

3-071
Gas-fired incinerator. Surveyor and Municipal Engineer (London), 123(3738): 45, Jan. 25, 1964. [0404, SWIRS].

A compact 2-1/2 cu. ft. gas-fired incinerator especially useful for the disposal of hospital waste is described. It has a stainless steel, refractory, brick-lined smoke burner chamber, a cast iron, direct flame, impingement type burner and automatic draught stabiliser for controlled combustion. The loading door is of the front chute-type. A timing knob allows adjustment of correct burning time. Combustion is smokeless, leaving only a fine ash.

3-072
Gas-fired incinerators. Institutions, 49(4):127-129, Oct. 1961.

Gas incinerators were said to provide an odorless, smokeless, and efficient means for on-site refuse disposal. Incinerators reportedly reduced refuse volume by 95 per cent, and permitted immediate disposal. Gas auxiliary burners may be used to dry any wet refuse, to increase the rate of burning, and for after-burning to lessen smoke and odor problems. Time, temperature and turbulence are key factors in incinerator design.

3-073
Gas incinerator for high buildings. Royal Society of Health Journal (London), 86(1):44, Jan.-Feb. 1966. [1755, SWIRS].

The design of the newest type of incinerator for high buildings such as high-rise apartments, office buildings, and hospitals is described. The flow diagram, which was shown at a recent exhibition, shows that the incinerator consists of a layer vertical chute which runs down through the building, discharging directly to the gas-fired burner, and a smaller duct parallel to the chute which acts as vent by which the cleaned gases can escape. There is a wall opening on each floor by which refuse is dumped into the chute and which is under negative pressure. The incinerator is controlled by a time-clock and usually operates for about 10 minutes every two hours although the timing can be regulated according to the amount of refuse produced in the building. The smoke is burned in a primary combustion chamber and the gases are cleaned in a washer before entering the exhaust flue. The small quantity of ash should be collected daily. By tilting the grate, non-combustibles such as cans and bottles can be removed.

3-074
Gee, D.A. The art and the science of waste disposal. Hospital Management, 108(5):50+, Nov. 1969.

The author traces his experiences with hospital waste disposal, first reminiscing about the sale of garbage to serve as food for hogs, then progressing to experiences with incineration and speculations about technology's potential to handle future waste volumes and compositions.

3-075
Graydon, S.W. Waste heat utilization from incinerator plants. Refuse Removal Journal, 4(10):8, Oct. 1961. [438, Refuse Collection and Disposal, 1960-1961].

Waste heat from incinerator plants can be utilized in several ways: (1) to furnish heat and power for the plant itself, for other plants, or for institutions such as hospitals and schools; (2) to furnish steam for operations requiring high pressure blasts of steam; and (3) to produce electrical power from the conversion of steam. A good example of waste heat utilization can be found at the Atlanta, Ga., incinerator, where operating expenses are offset by the use of this byproduct.

3-076
Greene, V.W. Microbiological contamination control in hospitals - part 6 - roles of central service and the laundry. Hospitals, 44(1):98+, Jan. 1, 1970.

The use of disposable items, transformed into solid waste the moment they are used, can generate contamination problems outside the patient care areas. Underdesigned incinerators create air pollution; when ground into the sewer lines, the disposables can create water pollution; if improperly disposed of on the ground, other problems are caused. Too many hospitals rush to use disposables without thoroughly evaluating the impact such a step can have on contamination control.

3-077
Groce, R.B. Disposable items add to hospitals' waste disposal problems. Hospital Engineering Newsletter, 14(1):1, Jan. 1969.

This article generally discusses the increased waste volume problems generated both by disposable items and their packing materials, then briefly evaluates four disposal methods (on-site incineration, hauling with landfill disposal, grinding with discharge to the sewer system, and pulping) to handle this increased waste.

3-078
Groce, R.B. Hospital wastes are on the increase. Texas Hospitals, 24:32-33, Dec. 1968.

The author estimates that hospital wastes have increased from 6-9 lbs/day/bed to 12-19 lbs/day/bed in the last 12 years because of disposables. In addition, disposables require larger storage areas and disposal areas. The author discusses advantages and disadvantages of the four disposal methods widely used by hospitals: incineration, hauling, grinding with discharge in a water suspension to the sewer, and pulping systems. In addition, the author defines air pollution, incineration, smoke, infectious waste, pathological waste, and refuse (including garbage and rubbish).

3-079
Handorf, E.C. Report on Hospital-Institutions Solid Waste Disposal, Memphis and Shelby County. Memo 334. Memphis, Bureau of Sanitary Engineering, Memphis and Shelby County Health Department, July 21, 1965. 10 p. [18030, SWIRS].

A special survey of 30 institutions in Memphis and Shelby County, in connection with solid waste disposal, incineration, the handling and control of radioactive material, and the protection of personnel handling the products is described both in tabular and narrative forms. These institutions include hospitals, nursing homes, clinics, sanatoriums, and related institutions. The type of waste, its collection or incineration, and the presence of radioactive matter is tabulated opposite the name of each institution from which it derives, and comments with respect to defects are made. The responsible administrators' names are given for each institution.

3-080
Hardie, M.C. Disposables--a United Kingdom point of view. Canadian Hospital (Toronto), 42(10):72-73, Oct. 1965.

Hospitals switching to disposables may initially encounter problems related to supply, distribution, and disposal. Disposal by on-site incineration is the best method of getting rid of disposables. If storage, collection and transport methods are satisfactory, a large central incinerator operated by trained staff is highly preferable to an inadequate on-site hospital incinerator.

3-081
Hart, F.C. Plant operation, waste handling. Hospitals, 44(9):80-83, May 1, 1970. [9665, SWIRS].

Collection, movement, and dispersal of hospital solid waste materials require a systems approach. Surveys indicate a range of solid waste production in hospitals from 6.5 lbs/patient/day for a small community hospital to 18-19 lbs/patient/day in a training hospital. In addition, a hospital generating 18 lbs of solid waste/patient/day produces about the same amount of dirty linen each day. Collection must begin with containerization at the source. Single use, moistureproof bags with special holders or lined waste receptacles provide sanitary containers for storage and efficient handling of waste. The transfer of solid waste from the service unit to the disposal point is the least developed of solid waste handling processes. While automation of solid waste handling is the ideal solution, if it is not feasible other recommendations include: establishment of a specific time for pick-up; training of personnel to use one pick-up procedure; use of as large a container as practical to reduce loads and handling; and design of a pick-up route that minimizes the time spent. Final disposal has attracted the most attention and caused the greatest apprehension among hospital administrators. Several processes can be used, including incineration, compaction, and wet pulping. Incineration is most prevalent and offers the greatest reduction in volume, up to 10 to 1 for typical hospital waste. Compaction has received considerable publicity in densely populated areas that prohibit incinerators, but the product is neither sterile nor odorless. Pulping systems combine pulping and water extraction to reduce the volume of waste, but if waste cannot be transported by pipeline, wet pulping will not be economically sound. Solid waste disposal studies must include an evaluation of capital and operating expenditures involved in the preparation and handling phases.

3-082
Hartman, J. "Will hospitals switch to paper dishware?" Modern Hospital, 100(4):128, Apr. 1963.

The future of plastic and paper dishware in hospitals clearly depends on how well and how convincingly problems of esthetics, costs, practicality, and solid waste disposal are solved. Paperware from meal service represents a sizable disposal problem unless frequent and regular removal or adequate incineration facilities are available to the hospital.

3-083
Healy, J.J. Disposable hypodermic syringes and needles. Illinois Medical Journal, 126(5):580, Nov. 1964.

The Illinois Department of Public Safety, Division of Narcotic Control, was asked to investigate possession by juveniles of discarded syringes and needles found in garbage cans and dumps. One discarded syringe was found to still contain a small amount of narcotic. Syringes, needles, and similar articles should be "totally destroyed by incineration or other means" before disposal.

3-084
Heckinger, S. Pulping machine cuts bulk of disposal by 85 per cent. Modern Hospital, 104(5):176, May 1965.

A new system at Mt. Sinai Hospital, New York, processes refuse into a finely macerated pulp, then transports and deposits the pulp in refuse containers on a loading dock. Containers are removed by the city. The system saves space and labor at a "modest" capital cost. The system daily disposes of 200 or more cans of refuse (largely kitchen waste) and enough corrugated material to fill completely a 22' x 18' x 10' room. Health and safety hazards were considered less than with incineration.

3-085
Heginbotham, F.W. Incineration. Hospital Engineering (Stevenage), 25:123-127, July 1971. [1696, Hospital Abstracts, 11(11), 1971].

A municipal incinerator plant is not suitable for hospital use, where on-site incineration is required and where pathological waste is involved. Hygienic handling of waste is important and the use of plastic sacks is now widespread, although this adds to the incineration problem. It is essential that all materials are entirely burnt and that a heat of 732°C. (1350°F.) is reached, as this is the temperature at which germs are destroyed. A secondary source of heat is therefore required. It is also necessary to have an after-burner, following the requirements of the Clean Air Act. A design incorporating these points resulted in the 'Gaserator'. Other design requirements were: (i) large charging door to avoid spillage; (ii) minimum maintenance; (iii) auxiliary firing by gas or oil; (iv) easy access for daily ash removal; and (v) flexibility in furnace design to suit various sites. A study was carried out to ascertain the constituents of hospital wastes. This is described and a table is given showing the combustion. The 'Gaserator' achieves complete combustion, eliminating harmful and malodorous air pollutants, and leaves a sterile residue. The process involved is described. A new incinerator is at present being designed to deal with such quantities of plastics as are produced by a pathological laboratory. This will provide smokefree incineration of waste having up to 100 percent plastic content. There are three photographs of the 'Gaserator' which is manufactured by Riley (IC) Products Ltd.

3-086
Herdman, W.E. Handling of hazardous wastes in hospitals. Progressive Architecture, 53:143, Sept. 1972.

Uniform codes do not exist for handling hazardous hospital wastes which can be classified as: laboratory wastes; human pathological wastes; animal wastes; syringes, needles, and sharps; chemical wastes; and radioactive wastes. The author discusses each of these categories, then suggests some procedures for waste handling and disposal. Despite its initial expense, incineration is the only current practical method for completely disposing of hospital wastes without imperiling the public health. However, the best waste handling system for each hospital will be dictated by variables unique to each institution.

3-087
Hicks, N. Hospitals being buried by their disposable items. Kansas City Times, 104(77):3B, Dec. 6, 1971.

Because of the increased use of disposable items "a spokesman for the New York City Environmental Protection Agency said hospitals were creating the fastest growing waste disposal problem". A moratorium on the indiscriminate use of disposables was suggested "until priorities could be set for their use". Edward Bertz of the American Hospital Association recommended that infection control be the primary concern in the decision whether or not to switch from a reusable to disposable item.

3-088
Hilborn, J. Throwing it away. Canadian Hospital (Toronto), 47(10): 78-79+, Oct. 1970. [18588, SWIRS].

Despite the problems of cost and waste disposal, the use of disposables in hospitals is likely to increase. The applications of disposables in burn therapy, aseptic techniques, isolation cases, and treatment kits for specific medical procedures are especially promising. The question of resterilization of disposables has not yet been resolved. However, true disposability, as in the case of the laundry bag that disintegrates in the washer, seems preferable. The advantages of disposable cutlery and dishware are not completely clear, but definitive data is being collected. Large hospitals in urban areas, which already have disposal problems, will have the greatest difficulties in dealing with the added waste load.

3-089
Hindenlang, A.W. Hidden dollars in waste disposables. Disposable Soft Goods, p. 12-14, Dec. 1970.

By converting the intrinsic fuel value of waste into useful energy by on-site incineration, hospitals can realize fuel and labor savings, in addition to reducing the community pollution problem. Ecology engineers cut internal collection waste costs in half with a pneumatic waste collection system, which was combined with an entirely new process of shredding unsorted hospital waste and burning in suspension. Burning, with continuous ash discharge, automatically occurs at 2000° F. without smoke or odor emissions, even when loaded with manure. Heat from the waste is recovered by passing the effluent gases through a waste heat boiler. The total estimated annual cost of pneumatic collection, incineration, shredding, and waste heat recovery (less the fuel value of the recovered heat) would be $22,500 for a 600-bed hospital, compared to a net annual cost of $55,000 for a hospital combining internal collection with incineration or haulage.

3-090

Hodges, F.B. Hazardous waste disposal. California Medicine, 117(6): 78-79, Dec. 1972.

Because health care institutions generate many types of hazardous wastes (including biological wastes, drugs, needles and syringes, and radioactive wastes), the author outlines some federal, state, and local regulations applicable to handling and disposal of such wastes in California to protect the public health. Discussion touches most categories of waste, including infectious waste and wastes from medical offices. Because waste handling poses occupational hazards to personnel, the California State Health Department "recommends a thorough physical examination of new employees at hazardous waste disposal facilities, with periodic medical check-ups thereafter" and requires physicians to report all incidents of occupational disease or injury.

3-091

Holbrook, J.A. Disposables require new disposal methods. Modern Hospital, 107(7):126-130, July 1966. [2573, SWIRS].

A recent study reveals a jump from nine to nineteen pounds hospital waste production per patient day in the last decade, largely due to the increased amount of packing material coincident with greater quantities of disposables and disposable material itself. The nineteen pounds is composed of 8.3 lbs. of garbage and combustibles and 10.7 lbs. of readily burnable material. Incineration on the premises, pulping system, hauling to dumps or remotely located disposal points, and grinding and removal as a water suspension in sewer systems stand as the major modes of disposing of hospital wastes. Incineration costs, consisting of labor, fuel, and maintenance, run about $6.05/hour (for 3300 pounds). This operation requires atmospheric pollution control plus an after-burner to insure complete combustion. Hauling expenses, varying with location and labor costs, also enlarge with greater use of disposables. Garbage grinders, however, can save money by reducing hauling expenditures. Pulping systems are effective to a certain extent, but they are not without many costly limitations. Changes in activity patterns have been noted resulting from disposable usage. The operations of receiving, unloading, storing, shipping, and incinerator tending, for example, all have been increased, while the workload on central supply has decreased. Advantages and operational savings will therefore come with increased disposable usage but many departments and services will have to be enlarged, making an immediate switch costly.

3-092
Holbrook, J.A. Hospitals and the growing problem of waste disposal. Hospitals, 42(5):57-60, Mar. 1968. [68-0054, Solid Waste Management, 1968].

Hospitals wastes may be classified as follows: garbage, which may be ground up and carried away in a sewer; wet waste incompatible with a sewer and difficult to burn; combustible wastes, paper, etc.; pathological and radioactive wastes which require special treatment; and noncombustible waste such as glass and metals. Two of the major problems confronting hospitals include transportation of the wastes within the hospital and its actual final disposition. Movement within the hospital may be effected through pneumatic tubes throughout the hospital, accepting both bagged refuse and laundry which may be separated at a central point. This may still require cart movement from the central collecting point. Pulping of the wastes, after separation of solid items, into a slurry may still cause problems due to the increased weight from the mixture with water and clogging of the system. The material must still be hauled to a central point outside the hospital for final disposal. Sewage disposal and incineration as methods of disposal are both subject to problems due to increasingly stringent air and water pollution laws. Hauling of waste can be highly expensive. The hospital will probably always have the problem of disposal of pathologic wastes and an incinerator connected with the hospital will probably be a necessity. In considering waste disposal methods, new air and water pollution codes should be understood and allowances be made for present and future compliance with them.

3-093
Hope, M.C. The hospital survey and construction program: environmental sanitation. American Journal of Public Health, 39(7):893-897, July 1949.

Incineration of all garbage and refuse generally provided the most satisfactory disposal, but other methods, such as sanitary landfill, can also be used. Grinders would eliminate storage of wastes which can be disposed of by such devices. Infectious wastes require special handling.

3-094
A hospital center solves its waste problems. Executive Housekeeper, 18(8):170-172, Sept. 1971.

After a two-year study of four compaction systems for waste handling and disposal, an 840-bed Washington D.C. hospital center replaced incineration with a system using 14 individual stationary compactors located in patient areas and one large compactor located in the dietary area to reduce annual costs by $20,000. In addition to savings in incinerator maintenance, in-hospital waste transfer, salaries for incinerator operators, and fuel for the incinerator, the new system realized "substantial cost savings in reduced wear and tear on the elevators, doors, floor and wall surfaces through a reduction in transporting trash to incinerators." The new compactors, leased rather than purchased, did not require new building space, and the system can be expanded merely by installing compactors in newly-constructed areas.

3-095
Hospital "disposables" also a fire hazard. Journal Medical Association of Alabama, 40:138, Aug. 1970.

Although the disposable products in use today reduce dangers of cross-infection and save on labor costs, they increasingly are a trash problem and a fire hazard. The present concern over air pollution raises the question of how to dispose of the disposables without incineration. "While they may be slow-burning, they still burn and will produce large quantities of toxic combustion products when burning under conditions of inadequate air supply," states Dr. Dornette of the Cincinnati (Ohio) Veterans Administration Hospital.

3-096
Hospital disposal problems: a special staff report. Disposable Soft Goods, p. 8-11, Dec. 1970.

Although most hospitals admit that waste disposal is a serious problem, surprisingly few hospitals canvassed have conducted significant studies of relative disposal costs, internal collection procedures, or improved disposal systems. Internal collection usually consists of maids collecting wastes which are placed in containers and transferred to a designated area for pick-up by the maintenance department. Most hospitals use on-site incineration in out-dated equipment operated by personnel unfamiliar with local or state air pollution requirements. Incineration is a great source of concern and conflicting viewpoints among environmental experts and governmental agencies, as well as among hospitals. The Bureau of Solid Waste Management recently reported that 75% of all incinerator facilities are inadequate, yet 94% of all on-site incineration reduced hazards and contamination. On-site incineration may be the eventual answer to rising scavenger costs and disappearing landfills. However, the surveyed hospitals claim that they cannot afford sophisticated, pollution-free incineration systems. Perhaps waste removal ultimately may become a public utility, necessitated by the increased quantities of waste (now 19 lb/bed daily) and higher plastic content. The article describes waste disposal systems at several hospitals, predicts that compaction will become more popular, and calls for the public and industry to regard pollution control and waste disposal expenditures as necessary operational fringes.

3-097
Hospital housekeepers discuss disposables. Executive Housekeeper, 18: 56+, June 1971.

The general feeling, concluded from a survey of housekeepers, was that "you can't put a dollar figure on convenience and morale" although disposables sometimes might be more expensive and do increase the volume of solid waste. The problem of disposing of disposables is an area of concern. One hospital reported a 100% increase in solid waste volume during the past two years, mostly from disposables. Compaction with hauling seems to be replacing incineration.

3-098
Hospital refuse destructor: successful application of gas firing. Hospital and Social Service Journal (London), 60:1281, Nov. 24, 1950.

A total of 177 beds in a hospital produced 500 lb. per day of solid waste, excluding food wastes. The existing incinerator, which used no auxilliary fuel, received little maintenance attention. The addition of a gas burner and arrangement for forced draft resulted in satisfactory operation. Use of gas increased the incinerator's capacity from 180 lb. per hr. to 400 lb. per hr.

3-099
Hospital waste disposal. Hospital Administration Currents, 12(4):1-4, Sept./Oct. 1968.

As hospital waste has increased from 6-9 pounds/patient/day to about 20 pounds, hospital planners look for permanent and improved disposal methods such as automated collection systems that will remove transportation of waste materials from public areas and elevators and require less manual labor. Several automated systems are described, both one way (e.g., pneumatic conveyor and tote box conveyor) and two way (three different types), for internal waste collection. Disposal methods discussed include incineration, pulping (with ultimate disposal at a sanitary landfill or an incinerator), and compacting (again with transfer to a landfill or incinerator). Difficulties caused during incineration by the high plastic content of today's waste are noted, and a central incinerator is suggested for multi-hospital cities to provide the most economical method of incineration. Another solution may be the cooperative installation, with the community, of a waste heat plant.

3-100
Hospital waste disposal a problem, says "Batelle". Waste Trade Journal, 68(23):7, June 1972. [21050, SWIRS].

A problem in municipal solid waste disposal that will become larger in the future is the disposable fabric product. The products, which are used principally in hospitals, are experiencing an annual growth of 14 percent. Recycling may be feasible in some instances; a fairly high grade of cellulosics might be recoverable from selected institutional sources, such as hospitals. Technology for removing some polymeric coatings and binders from such materials is available for certain applications. Enhancing the biodegradability of the fabric products may also solve part of the problem, but it also can raise some new ones. Accelerated degradation of the materials requires water. This water, in turn, can be a source of pollution problems associated with leachate from landfills, including the more rapid generation of methane, which is a major byproduct of anaerobic degradation. As far as paying for such solid waste handling is concerned, if the cost of management is to borne by the products, the factor of weight versus volume has to be recognized. While cellulosics, of which the products are a part, comprise only 50 percent of the municipal solid waste tonnage, they constitute about 70 to 80 percent of the total volume. Therefore, such products may have to share the cost more closely related to their volume than weight.

3-101
Hospitals & pollution: dead heat on a merry-go-round. Perspective, p. 28-30, Fall 1971.

Because hospitals "as guardian of the public health" must typify environmental conscientiousness, hosptals must develop waste management programs to handle burgeoning waste volumes without endangering "the health balance in the environment". Although incineration in compliance with air pollution regulations is suitable for combustible and pathological wastes, noncombustible plastics must be disposed of by bricking, high-density compaction, low-density compaction, or non-compaction hauling. An alternate method for disposing of waste paper is wet-pulping, yet wet-pulping is generally unsuitable for pathological wastes. Because incineration appears to be the most economical and universal disposal method, most hospitals will select that method--yet the costs of air pollution control devices for the incinerators often makes incineration prohibitively expensive. Presently no single method of waste disposal is ecologically and economically optimal for hospital solid waste.

3-102
How do hospitals like disposables? Hospital Administration in Canada (Don Mills, Ontario), 13(2):51-52, Feb. 1971. [13687, SWIRS].

Canadian hospitals used relatively fewer disposable fabric goods than U.S. hospitals. This is primarily because of the storage and disposal problems that single use items create. However, the most favorable acceptance has been shown towards O.R. drapes and sheets, nurses' caps, bedpan covers, isolation gowns, aprons, conductive boot covers, examination gowns, and surgical bundle wrappers. Areas of greatest acceptance are the surgical and isolation areas. Small hospitals, it was also noted, use slightly more disposables than medium and large hospitals.

3-103
How to crush waste disposal problems. Safety Maintenance, 124(6):59, Dec. 1962. [323, Refuse Collection and Disposal, 1962-1963].

This large Eastern hospital uses a separate incinerator and waste disposal building to dispose of its refuse. The building has two large loading doors to allow entry of collection trucks. Rubbish is dumped on the floor and pushed into incinerator openings. A special feature of the disposal plant is continuous converging steel plates mounted on heavy roller chains. It handles up to 7-gallon cans, and disposes of the common No. 10 can at a rate of over 5,000 per hour.

3-104
Hunt, I.H. Waste disposal - a growing international problem. Canadian Hospital (Toronto), 47(10):57-60, Oct. 1970. [11691, SWIRS].

What is clearly needed in the solid waste disposal area is the establishment of a top level commission with world wide representation to examine the problem in depth and to ascertain ways and means of arriving at a solution on a national and international basis. In the health care field, the growing problem of waste materials disposal is one which is causing a great deal of thoughtful concern to many administrators of Canada's hospitals. During the past ten years the volume of hospital waste materials has increased from seven to eight lbs and of materials/patient/day to almost twenty-six lbs, and it becomes apparent that even larger amounts could be expected as hospital use of disposable supplies continues to expand. The various types of materials generated by the average hospital operation are classified as: garbage and other materials that can be ground in a disposer unit for disposal through sewer systems; wet waste incombustible materials; pathological and radioactive wastes; and noncombustible waste. Present methods of hospital waste disposal are incineration, pulping, compacting, and bagging. The incinerator should be a high temperature unit of either grate or solid hearth construction. Thermoplastic, the softer group of plastic materials, cause the major problems in the incineration process. Some hospitals contract with a commercial firm for compacting of waste materials. New pulping systems have overcome most of the problems associated with older systems. Another combined system features pulping and incineration, where pulp is held in a storage bin until a full load is accumulated and pulp is dried in the storage bin with heat recovered from the incinerator flue.

3-105
Iglar, A.F. Hospital solid waste management. Critical Reviews in Environmental Control, 1(4):507-550, Jan. 1971. [15840, SWIRS].

This 4-year study at the University of Minnesota reviews hospitals' problems with solid waste management. In hospitals, solid waste includes radioactive material, garbage, ashes, human tissue, pathological cultures, and rubbish that is both combustible and noncombustible. Today, this waste is at the level of 10 or more lbs per day per bed, due primarily to the increase in disposable single-use items. Because of the volume of waste each day, hospitals need to reassess the disposal systems they are now using. These present systems included: incineration of pathological tissue and other combustibles; pulping systems to reduce trash volume; burial to eliminate the danger of radioactivity; and hauling contracts to move the wastes to disposal sites such as landfill areas. However, each of these methods has inherent dangers; therefore, precautions must be taken if possible. Incinerators must be updated to permit handling of dry combustibles and to avoid sludge formations by melted plastics; also, emissions should be kept minimal, particularly pathological emissions. Ground or shredded wastes should be disinfected. Any hazardous waste should be eliminated with extreme caution so that contamination can be avoided. Landfill sites should be periodically checked for dangerous or infectious agents. Finally, personnel dealing with the elimination of solid wastes should be thoroughly trained in precautionary measures of waste disposal to insure the safety of staff, patients, and community.

3-106
In building or remodeling - don't neglect waste disposal planning. Hospitals, 30:62+, Feb. 1, 1956.

A successful solid waste handling system is most easily and economically developed during the earliest stages of planning and designing the hospital, but development at any point in a hospital's existence must consider numerous variables. In order to state basic sanitary principles and precautions applicable to waste handling, the American Public Health Association prepared a questionnaire covering a one-week waste collection period, then sent that questionnaire to hospitals across the country. The responses of twenty-nine hospitals were analyzed "to develop a composite picture of such information for each category of wastes found in hospitals." Results indicated that weights and volumes of combustibles double (whereas production of garbage and non-combustible wastes is halved) between hospitals of 100 and 500 patients, respectively. Correspondingly, total waste production decreased from 9 to 6 1/2 lbs. per patient per day for 100 and 500 patient hospitals, respectively. Disposal methods for garbage, combustibles, non-combustibles, and surgical/autopsy wastes are detailed. Fourteen of the hospitals fed garbage to hogs, however, that garbage should be precooked. The Association recommends that hospital waste handling and disposal systems be designed and operated to ensure "complete freedom from sanitary hazards" by using protective clothing, cleaning waste containers after emptying, and use of disposable can liners, as well as mechanization of waste container washing facilities and minimization of waste transfer operations.

3-107
Incineration of disposable goods. Hospital Engineer (London), 18(1): 17-19, Jan. 1964.

Studies of incinerator emissions from 18 types of disposable products showed that most could be burned properly to avoid producton of offensive gases. However, polyvinylchloride (PVC) burned to produce hydrogen chloride gas which might not be a problem if PVC constitutes only a fraction of the incinerated refuse. Because satisfactory alternative materials usually are available, the article suggests discriminate use of PVC products or disposal by an alternative method.

3-108
Incinerator. Engineering (London), 197:377, Mar. 13, 1964. [868, SWIRS].

A 2-1/2 cu. ft. gas fired incinerator is described with emphasis on its use in disposal of hospital waste. The loading door is operated by foot pedal, leaving hands free, and an interlocking device prevents the gas being on when the door is open. Adjustment of the timing knob to give the burning period required results in almost total combustion. The venting of the combustion chamber is briefly explained. Dimensions and Btu ratings are included in the article.

3-109
Incinerator controls imposed in two states. Modern Hospital, 110(1):23, Jan. 1968.

The article updates incinerator control laws passed by New York and New Jersey. After January 1, 1968, any new incinerator in New York must prove by test results that it meets air pollution standards or the incinerator will not be permitted to operate. The New Jersey Department of Health is requiring permits and operating certificates for construction, installation, or alteration of equipment capable of causing emission of air contaminants. An emission test may be required at the expense of the applicant.

3-110
Incinerator saves 25 percent in disposal expense. Modern Hospital, 102(5):138-140, May 1964. [64-0521, Solid Waste Management, 1964].

By installing its own gas-fired incinerator, the 300-bed Grandview Hospital of Dayton, Ohio, has eliminated flies, odors, unsightly accumulation of waste, and the noise of trash collection operations. The rising cost of the previously employed collection service was another disadvantage of the older system. The new incinerator, which had a daily capacity of 950 lb, will keep pace with the hospital's growth and with the increased use of disposable and packaged supplies. The automatically timed incinerator can handle both plastic and rubber items, plus organic wastes from surgery. It is attended by two part-time employees. Cost of the incinerator itself is $9,800.

3-111
Incinerators and the modern hospital. Hospital Management, Planning and Equipment (Sevenoaks), 27:799, Oct. 1964.

The increased use of disposables and more stringent air pollution regulations are factors which forced improvements in incinerators such as auxillary heating to dry waste before burning and the use of after-burners, spark arrestors and dust traps to clean flue gases. The use of small ward incinerators instead of a large centrally located incinerator reduce the possibility of infection spread and the time and labor necessary to collect and transport the waste. However they are easily overloaded.

3-112
Incinerators and waste disposers. Hospital Building & Engineering (London), 5(4):28-29+, July/Aug. 1972. [1605, Hospital Abstracts, 12(11), 1972].

A check list is given of the points to be borne in mind when a specification for an incinerator for a particular hospital is being drawn up. There are five main needs: determining size of incinerator (number of beds, type of hospital, types of waste); collection and loading; operation; services (type of fuel or electric current); and siting (access, weight and construction of chimney, etc.). Details are also given of various types of incinerator, shredding machine, compact and crusher unit, with manufacturers' names and addresses.

3-113
Influence of disposables on the laundry. Instelling-Management (Den Haag), 3(11):709, Nov. 1971. [399, Hospital Abstracts, 12(3), 1972].

For a number of reasons it is unlikely that the use of disposable "linen" products will increase markedly in hospitals during the next few years. These disposables are not cheaper than traditional linen goods, there are no standards for assessing them, and their storage and final disposal present many problems.

3-114
International Commission on Radiological Protection. Report of committee V on the handling and disposal of radioactive materials in hospitals and medical research establishments. I.C.R.P. Publication No. 5. Oxford, Pergamon Press, 1964.

Sightly contaminated solid waste may be disposed of with ordinary waste, but wastes registering larger amounts of radioactivity (over 100 mc) must be incinerated or buried. Incineration sometimes can be an effective disposal method for radionuclides which form gaseous products when waste is burned. Under suitable conditions, burying waste at least one meter in a municipal site is acceptable. The report discusses general principles of radioactive waste management including proper storage and disposal.

3-115
Isaacman, T. Wesley saves money by "throwing away meals". Modern Hospital, 110(6):106-107, June 1968. [68-0063, Solid Waste Management, 1968].

Chicago Wesley Memorial Hospital is saving $30,000 annually by using disposable trays, utensils, and containers that are thrown away with the garbage. The hospital has been using compactor units to absorb its debris. These are sealed 33 cu ft boxes which contain built-in grinders and automatic germicidal sprays. Three times weekly, a commercial firm backs a compactor into one of the hospital's truck loading bays. Sanitation personnel then dump all the hospital's solid wastes, including garbage, junk, paper, and old furniture into the box which then grinds the debris and squeezes it into as small a bundle as possible. When the commercial firm brings the next empty compactor, it carts away the full box. The incinerator is still used but no longer overheats as was its custom before the compactor plan was adopted.

3-116
Jacobsen, T.L. Compaction system reduces disposal hazard. Hospitals, 43(3):89, Feb. 1, 1969.

Because increased waste production and increasingly stringent air pollution regulations will preclude waste incineration by many hospitals, the author suggests three new methods of waste disposal: (1) converting all wastes into a slurry for final disposal; (2) using a hammer mill to break up all large items for compaction, burning, or a combination; and (3) compacting waste. The author details one hospital's conversion from a burning/hauling combination system to a compaction system, although incineration was used for pathological wastes. Compaction reduced waste bulk to 20-25% of the original volume and was suitable for most wastes. The 27 cubic yard container was removed three times weekly and unloaded at a landfill. The new system reportedly reduced costs, air pollution, and odors; eliminated the safety problems of exploding aerosol cans in the incinerator and of needles and syringes; as well as providing more usable space in the hospital.

3-117
Jany, V. Experience with disposable blankets and sheets in the Auguste-Viktoria hospital in Bad Lippspringe. Staedtehygiene (Uelzen/Hamburg), 19(8):173-174, Aug. 1968. [68-0905, Solid Waste Management, 1968].

The Auguste Viktoria hospital treats patients with respiratory diseases (tuberculosis). It has a capacity for about 300 male and female patients who remain in the hospital mostly for 6 months and more. The disposable blankets which were introduced a short while ago, proved to be an enormous success. They have a life expectancy of about 12 weeks. They come in sealed plastic bags. The used blankets go to the hospital incinerator. No dry cleaning of woolen blankets and no disinfection is required. The blankets are made of a soft plastic fiber which warms just like a feather bed. Disposable towels have long since been in use, but a switch to single-use towels is recommended. Disposable sheets and pillows are on the market but their use remains limited to special cases. However, a breakthrough in this is imminent.

3-118
Jernigan, A.K. The care and feeding of waste disposals. Hospitals, 45(16):86-87, Aug. 16, 1971. [18590, SWIRS].

Trouble, in waste disposals, can occur at the point where the impellers force the waste against the teeth of the grind ring. During the chopping, shredding, and mixing of waste with water, tiny droplets can be thrown into the air above the disposal. If the disposal is not ventilated properly, these droplets can be a source of contamination for clean dishes. Construction or remodeling plans for the hospital dietary department should identify the locations where disposals are needed. Areas producing the greatest volume of waste are dishwashing, vegetable preparation, and potwashing. It is usually more economical and sanitary to place disposals at all locations where waste originates. A general rule of thumb for the number of disposals needed in a hospital is one disposal for 50 beds, two for 100 beds, and three for 200 beds. When buying a disposal, rotordiameter and size of the body must be specified along with horsepower.

3-119

Jernigan, A.K. Disposables in food service. Hospitals, 44(8):80-81, Apr. 16, 1970. [9414, SWIRS].

Disposable tableware has gained considerable attention as a means of lowering costs by reducing dishwashing and the corresponding labor involved. The largest savings are realized through the reduced expense of dishwashing machine operation and upkeep, including replacements, repairs, and detergent used. The use of disposables eliminates initial capital expenditures for ware-washing machinery, china, dish dispensers, and other dish-handling equipment. Paperware stores compactly, and is relatively lightweight. The problem of sanitation is virtually eliminated with disposable service. Disposables as purchased have a bacterial count low enough to be completely safe for any food service. The chief disadvantage in the use of disposables is the task of processing the waste. The usual method has been to hire an outside service to pick up the waste. On-site processing of disposable waste by incineration is restricted in some municipalities because of emissions of particulate matter and other objectionable air pollutants. Another method of on-site processing of waste is by means of waste-pulping machines. These machines grind paper and plastic wastes with water. The water is then extracted from the slurry, and the semidried, odorless pulp is packaged for removal. The use of compactors has gained attention since the increase in anti-incineration legislation. Contractors compress the waste into containers, thereby reducing the volume by a ratio of 6:1.

3-120

Johnson, H. Trash trough facilitates incinerator disposal. Mental Hospitals, 9(4):37-38, Apr. 1958.

To facilitate the charging of waste into an incinerator which had a small charging door, a metal trough was installed from which a large quantity of waste could be pushed into the incinerator. Metal baffles were used to limit the amount of smoke escaping while the incinerator door was closed.

3-121
Johnston, J.H. Using incinerators for waste disposal. Hospital Engineering Newsletter, 14(7):4, Nov. 1969.

The article emphasizes the roles of hospital engineers and incinerator operators in the proper selection and operation of hospital incinerators for disposing of hospital wastes in compliance with air pollution standards.

3-122
Jopke, W.H., and D.R. Hass. Bacterial Contamination in Hospital Dishwashing Facilities, Phase I: Studies on Food Waste Disposers. Report of Research under Contract PH 108-67-65, Division of Hospital and Medical Facilities, Bureau of State Services, Public Health Service. Minneapolis, University of Minnesota, School of Public Health, March 1968. 66p.

Two types of disposers for food wastes are the revolving turntable commonly used in hospitals and the hammermill type. This study of the revolving turntable type tested three designs: the grinding ring, shredding and sizing ring, and the smooth chamber types. Capacities ranged from 300 to 1200 lb. per hour. The test room simulated conditions in a typical dishwashing facility and bacteriological samples were collected using a tracer organism. Although each type of disposer evidenced contamination, the contamination level appeared to be influenced by the disposer construction. Contamination decreased greatly with distance but showed no directional pattern of dispersion. Additional study of enclosure and exhaust systems to control the spread of organisms showed that the exhaust system significantly reduced the level of tracer organisms in the air.

3-123
Jopke, W.H., D.R. Hass, and A.C. Donovan. Food waste disposers and contamination. Hospital Progress, 50:47-52, Oct. 1969.

Possible sources of contamination in hospitals are under constant investigation by health authorities. The University of Minnesota, under a USPHS grant, conducted a study of food waste disposers and their relationship to aerosol dissemination and contamination. Findings reveal that disposers generate bacterial aerosol regardless of mechanical design. A box-type exhaust system provided an effective way to minimize aerosol dispersion into the area and afforded protection to the dishwashing facility and clean dishware. Training of operating personnel also is mandatory.

3-124
Judge, D. Two disposal systems pulp it, pipe it, burn it. Modern Hospital, 118(3):76-77, Mar. 1972. [1143 Hospital Abstracts, 12(8), 1964].

The waste disposal system at Deaconess Hospital, Evansville, Ind., consists of a SOMAT wet pulping machine for volume reduction of waste and a Des-Inerator, an automatic incineration oven which complies with federal standards. The two systems, a building to house them and installation cost $175,000. Running costs are less than for the pulping alone and there is some saving of manpower. Rubbish is sent in plastic sacks down a central gravity chute. At the bottom it breaks an electric eye beam which activates the pulping system. The waste lands in a bin from which it is drawn on a conveyor belt into a large tank partially filled with water. Items such as metal containers which cannot be ground are ejected but other rubbish is shredded and mixed with water. After pulping the slurry is pumped to the incinerator installation, an extractor reduces the water to about 70 per cent by weight and the pulp goes into a surge tank from whence a series of conveyors feed the pulp at a constant speed into the incinerator where a rotating wheel distributes it evenly in the main combustion chamber. Products of combustion such as smoke and particulate matter are drawn into the afterburner for completion of combustion. The incinerator operates from 8 a.m. to 7 p.m. and the 9,000 pounds of waste processed daily are reduced to two coal buckets of ash. Items which cannot be pulped are collected by contractors.

3-125
Kaiser, E.R. Survey your garbage, then burn it. Modern Hospital, 114(5): 134+, May 1970. [9638, SWIRS].

On-site incineration reduces hazards and contamination in the handling of hospital wastes. Recent improvements in incinerator design and the use of modern, high efficiency washers for the combustion gases have made this method of waste disposal more acceptable. In general, refuse which can be incinerated consists of free moisture, dry combustible matter, and inert substances. The final weight of incinerated matter is from 5 to 10 percent of the weight of the original refuse, depending mainly on the amount of metal and glass present in the refuse. In multi-story hospitals, the use of chutes with doors at each floor is a convenient arrangement for collection of refuse. A recent innovation is the vacuum system of transporting refuse from chute doors on the floors to distant receiving areas. Before choosing the incinerator size to be installed in an existing hospital, the administration should make a survey of the types and weights of refuse it must process. The incinerator size required depends on the weight of the refuse to be burned/hour. The typical interval for firing refuse is once every 15 or 20 minutes. For complete combustion, the operating temperatures in the primary and secondary combustion spaces should range between 1,400 to 1,800 F. Calorific values of dry, inert combustibles vary from 7,500 to 19,000 Btu/lb. Stringent requirements of federal, State, and local regulations directed toward the prevention of air pollution can be met with incinerator flue-gas cleaners.

3-126
Kaminker, D.M. Recent developments in waste-handling equipment. Hospital Administration in Canada (Don Mills, Ontario), 14:56+, May 1972.

The author discusses the advantages and disadvantages of small compactors, central stationary compactors, shredding machines, pulpers, pneumatic tubes, hammermills, and automatic carts, monorails and other automated equipment. Compactors are relatively inexpensive when compared with more sophisticated systems, but they offer no saving in transporting waste within the hospital. Pulping and pneumatic systems can be fully automated from the point of loading to point of deposit in the haulage container or incinerator. Disadvantages include the costs of the two systems, complex pulper machinery requires frequent maintenance, pneumatic tubes take up considerable space and the system does not reduce waste volume. Although automated carrier systems have been installed in hospitals, they are often not used to transport waste because of the possibility of contamination.

3-127
Kaplan, H. Equipment that works on the refuse disposal problem. Architectural Record, 148:133-136, July 1970.

Although most institutional waste is either incinerated or hauled to a landfill, increasingly stringent restrictions on those two disposal methods require more sophisticated equipment. Incineration reduces waste volume but generates smoke because the fuel and combustion conditions are not ideal. Although particulate pollutants can be removed by various means, "only the scrubber is suitable for incinerators of small and moderate size". Compaction similarly reduces volume, as well as minimizes odor and rodent problems at landfill areas. The article describes both a scrubber and a compactor currently on the market, then compares the two devices for application, space requirements, and efficiency.

3-128
Kenny, A.W. The safe disposal of radioactive wastes. Bulletin of the World Health Organization (Geneva), 14:1007-1060, 1956.

Solid radioactive sources enclosed in sealed containers in permanent installations cause no disposal problems, except in case of accident. A few radioisotopes are used internally for therapy, in addition to diagnostic uses. Solid radioactive waste from hospitals primarily consists of contaminated glassware and "tissue papers used for mopping up". Combustibles "can be handled in the hospital incinerator," and some hospitals bury noncombustibles. Radioactive material must not be salvaged.

3-129
Kensett, R.G. Methods of hospital waste disposal. Hospital Engineering (Stevenage), 26:1-6, July 1972. [1606, Hospital Abstracts, 12(11), 1972].

The overall average quantity of waste produced in hospitals is four pounds per occupied bed per day. Some types of waste (non-infected paper, tins, clean and non-infected textiles) can be sold as salvage. The main types of waste are: ward waste; maternity ward waste; kitchen waste; pathology and theatre waste; non-infected paper; and plastics and plasticized paper articles. The five existing methods of disposal are briefly described and their advantages and disadvantages discussed. They are: disposal via the local authority; controlled tipping; compacting; maceration; and incineration. The conclusion is that incineration is likely to remain the most popular method for many years to come. It is becoming economically worthwhile to consider the use of a large central plant, perhaps incorporating waste-heat recovery. Any plan to install new plant in a hospital should be discussed with the local authority who may be willing to take on the hospital's load at their own central plant.

3-130
Kern, H.D. Liquid wastes. In Salkowski, M.D., ed. Disposal of Single-Use Items from Health Care Facilities; Report of the Second National Conference, September 23 and 24, 1970. Monograph No. 8. Ann Arbor, National Sanitation Foundation, Sept. 1970. p. 24. [15535, SWIRS].

This report is a summary from notes taken during a slide presentation. It concerns a test conducted in two hospitals in Los Angeles, Children's Hospital and Memorial Hospital. Two types of grinding units were developed as part of the test. A small unit was installed on the nursing unit to accept waste materials collected from the patient rooms and accumulated in containers at the nursing station. A larger unit was installed on the basement level to accept other wastes collected from the floors in bags. The materials disposed of were primarily small bottles, needles, and syringes. The test indicated that if the system were expanded to totally supplant the existing system, cost would not be materially increased; it also indicated that existing personnel could be utilized and trained in a minimum time to wet grind the waste materials. Some problems of noise, aerosol spray, damage to the shear ring of the grinder, and inability to handle some material, were encountered but have since been largely overcome. The study also demonstrated that while grinding is a method of preparing waste for disposal and waste transport it is not a final disposal method. Final disposal depends upon the community sewage treatment facilities.

3-131
Kerr, J.A. Disposing of disposables: a noisome dilemma with real growth possibilities. American Public Works Association Reporter, 36(12):14-16, Dec. 1969. [7739, SWIRS].

The dilemma of the disposable diaper is merely one of the many problems that the throwaway age of paper and plastic disposables may soon pose to public works officials. The problem becomes most critical when the discarded disposables contain body waste or pathogenic contamination. One diaper design includes instructions requiring the user to remove the plastic backing and rinse the rayon lining until the padding falls off into the water. Only the rayon lining, which should be cleaned by the rinsing action, should be wrapped in the plastic backing to be deposited into the trash can. The difficulty occurs when people do not follow instructions. Just how many fail to do so is not known. It is claimed that as long as manufacturers persist in producing materials that complicate the municipal sanitation field we will find ouselves in the situation of trying to solve problems which should never have existed. One consultant has reported difficulty with comminutor and other grinding equipment from tough plastic, cylindrical tampons. These resist grinding and accumulate in the channels until they are taken out. Great difficulty has been reported with high wet-strength cellulose, paper-like products passing through screens, or comminuted, adding to the floating scum as well as settled activated sludge problems. This material also hangs up on piping, weirs, and clogs openings in smaller sewage treatment plants. Machinery has been developed for reducing such mechanical and process difficulties, and some are described. The formidable increase in solid waste production in hospitals, is largely the result of the wide acceptance which single-use articles have gained in the medical, surgical, and institutional environment.

3-132
Koppenhauer, O.E. Incineration of hospital wastes. Hospitals, 35(9): 91-94, May 1961.

Refuse disposal was described as an operation to protect health. A hospital incinerator should have a shelf above the fire to allow wet refuse to dry before combustion. Hospital incinerators may have problems with phosphorus from bones glazing the bricks, grates, etc. There was reportedly no easy way to remove this material. However, incineration was considered the only safe disposal method for experimental animals. Hospital wastes may contain materials (e.g., alcohol) which burst into flame quite quickly. To protect personnel, interlocks were said to be needed on charging doors or chutes, front feed should be used, incinerator locations should be well ventilated, and training of personnel must be provided. Higher temperatures (about 1700°F.) were also needed to burn pathological wastes preserved in alcohol, and flow of air must be adequate to satisfactorily dilute any radioactive material. Safety from fires must be considered with an incinerator.

3-133
Koren, H. Why this hospital employs a sanitarian. Modern Hospital, 106(5):120-122, May 1966.

"An increasing potential for the spread of infections in hospitals has created the need for a new member of the hospital team, the hospital sanitarian, whose specialty will be infection control." Study by such a sanitarian at the Philadelphia General Hospital resulted in more frequent waste hauling from the hospital and garbage removal seven days per week, rather than six. An insect and rodent control program was initiated in related work.

3-134
Kraus, G.P. Burning may not be the best method of trash disposal. Hospitals, 43(1):67-70, Jan. 1969. [1263, Hospital Abstracts, 9(8), 1969].

The author conducted a survey of a random sample of hospitals in the United States to study their present methods of refuse disposal and their future plans. Of the 91 hospitals in the sample 67 had incinerators but only 51 used these for burning general refuse. Of these 49 percent are considering a change, either to do away with burning altogether or to redesign their incinerators. Only 26 hospitals were quite satisfied with their incinerators. Cost data reveal that the total cost of refuse disposal is increased where incinerators are used. The alternative to burning is physical removal of refuse either by the sewage system or by collection and carrying to dumps, landfills or outside incineration. Physical removal from hospitals was found to be most commonly by private contractors and the use of volume reducing machinery is increasing. The cost of physical removal is influenced mainly by the size of the hospital rather than whether contractors or the hospitals themselves do the removal. The main problems with incineration are volume and air pollution, although the importance of proper loading must not be overlooked. One of the main problems with physical removal is the temporary storage of refuse which is a potential hazard to health and hygiene. Capital outlay for equipment has to be considered as well as the cost of a contract and the availability of dumps. Final decisions as to methods of disposal must be based on local needs and conditions.

3-135
Kraus, G.P. A Survey of Trash Disposal Methods Used by Selected General Hospitals. Washington, D.C., The George Washington University, 1968. 47 p. [HU2007, Abstracts of Hospital Management Studies, Vol. VI, 1970].

Study surveyed 91 general hospitals of 300 beds or more in the 29 cities in U.S. having population of over 800,000 to determine methods used for trash disposal and any plans for the future in this area. Data from this survey were compared with data from hospitals in Houston, Dallas, and San Antonio. At least one government and one non-government hospital in each city was included. Study found there were two basic disposal methods used: incinerator and physical removal. Of 91 sample hospitals, 67 own, rent or share an incinerator, but 16 of these hospitals do not use them for waste disposal except for pathological waste in some instances. Of 51 hospitals using incinerators, 10 are planning to do away with them and 15 are going to redesign them. Data show in all categories of hospital size, except in 700-799 bed group, total cost of disposal programs are lower with hospitals not operating incinerators. Study found trend is away from incineration towards physical removal due to costs and air pollution laws. Also survey showed no proof volume reducing equipment significantly lowers total refuse costs. The three Texas cities showed no difference in overall disposal program from rest of the nation.

3-136

Krellen, F.R. New York City's bulk waste removal. Executive Housekeeper, 19(1):34-36+, Feb. 1972.

The New York City Department of Sanitation collects refuse from more than 100 institutions each of which produces more than 100 cubic yards of uncompacted waste per day. Because of an incinerator ban except for infectious and specialized contaminated wastes, hauling was the only alternative. To cut down the frequency of collection, compactors were introduced. The author describes the various types of compaction systems and their cost. The use of compactors freed valuable loading dock or other storage space at the hospitals, and the sealed metal containers are a barrier to insects and rodents.

3-137

Kroke, R. Waste disposal in the hospital. Krankenhaus (Colgne), 58(3):90-93+, Mar. 1966. [1862, Hospital Abstracts, 6(11), 1966].

The collection, transport, and incineration of waste, the operation of the incinerator, the disposal of the ash, the removal of dust from the flue gases and the German regulations dealing with waste disposal are discussed. A diagram of an incinerator is reproduced. Incinerators cost from DM 20,000 upwards and, for a 2,000-bed hospital, running costs are DM 0.10 per patient day. In a hospital with 2,500 beds and 2,500 staff the volume of waste is about 3.33 litres per patient day. Provision should be made for washing waste bins and for storing waste for short periods at the incinerator. The dust content of the gases leaving the chimney should be less than 200 mg. per cu.mm. and the aim should be to keep the sulphur dioxide content as low as 0.5 per cent.

3-138

Kuyawa, J.G., and G.F. Hewitt. An Analysis of the Trash Removal System. Ann Arbor, Community Systems Foundation, 1967. 33 p. [HU2005, Abstracts of Hospital Management Studies, Vol. IV, 1968].

Analysis of Housekeeping Department's personnel utilization and other factors affecting trash removal procedures with service contract. Proposals recommend rescheduling pick-ups and an additional dumpster or a compaction unit in the hospital to cut down idle man hours and trash pile-up. Future contract modification indicated.

3-139
Lambie, J.A. Sanitary landfills. In Salkowski, M.D. ed. Disposal of Single-Use Items from Health Care Facilities; Report of the Second National Conference, Sept. 23 and 24, 1970. Monograph No. 8. Ann Arbor, National Sanitation Foundation, Sept. 1970. p. 19-23. [15534, SWIRS].

Since disposables have become important in hospital management not just for economy but for control of infections, it should be clear that to stop using disposables is hardly a workable solution. One method of disposing of 20 to 30 lb of waste per patient per day is to use it as sanitary landfill. A landfill is a method of disposing of refuse on land without creating nuisances or hazards to public health or safety, by utilizing the principles of engineering to confine the refuse to the smallest practical volume, and covering it with a layer of earth at the conclusion of each day's operation or at such more frequent intervals as may be necessary. Such sites may be classified into three groups: one at which any type of waste material, including all liquid industrial wastes, may be accepted; one which is permitted to accept ordinary rubbish and refuse and certain innocuous liquids in areas where usable groundwater may be polluted; and one which may accept only inert, irreducible materials which are non-water-soluble. A 3-year study of such landfills in the Los Angeles area has proved significant; results include extending the knowledge of gas movements, predicting landfill subsidence, and developing criteria and uniform standards. Another study was designed to evaluate the problems of solid waste generated in multistory buildings and hospitals. It showed that waste disposal within the institutions is often far from ideal, although mechanized and automatic systems exist for conveying refuse from one area to another The study also showed that methods of on-site processing would properly condition waste materials. However, the findings still indicate that general inadequacies prevail both in the operation of conventional solid waste systems and in the development and use of hardware.

3-140
Larkin, M.C. New trends in hospital incineration design. Air Engineering, 3(4):33-36, Apr. 1961.

Current problems with hospital incineration were reported to include: (1) less food preparation garbage and more paper, due to use of frozen foods; (2) less garbage handled, due to grinders; (3) increased paper (from disposables and packagings); (4) thermal value of waste increased from 2500 to 6500 BTU/lb. and (5) operation by untrained persons. The old horizontal hearth, wet type incinerators are not able to handle this dry waste thus producing greater flyash and smoke carry over due to higher gas velocities. The use of heavy duty "destructor" incinerators, previously reserved for special wastes, may be the solution.

3-141
Lehmann, K. Modern waste incineration. Krankenhaus Umschau (Kulmbach), 34:102-108, Mar. 1965. [1339, Hospital Abstracts, 5(9), 1965].

The ever-increasing use of disposables emphasises the need for efficient waste disposal in hospitals and this paper presents an account of modern incineration practice. The subject is dealt with under the following heads: (i) requirements of a modern incinerator; (ii) choosing and setting up an installation; (iii) the incineration of waste; (iv) supplementary firing; (v) after-burning; (vi) air for combustion; (vii) dust removal; (viii) furnace construction with dust-free ash removal; (ix) chimneys; and (x) use of surplus heat.

3-142
LeTourneau, C.U. Disposable supplies: problems of disposal. Hospital Management, 94(2):14, Aug. 1962.

Chances are that a hospital is liable if a child injures himself with an object he has found in a hospital trash can. Consequently, trash cans must be guarded, and used hypodermic needles must be destroved. High temperature incineration is the best way to dispose of disposables.

3-143
LeTourneau, C.U. The management of supplies - part II. Hospital Management. 103(6):57-59, June 1967.

The most important aspect of handling materials in the hospital is to deliver them where the materials will do the most good. Several distribution methods are manual carriage, elevators, conveyors, or chutes. The residue from consumed products must be collected rapidly and destroyed as soon as possible to eliminate hazards of bacterial contamination or radiation. Ideally, if all materials used in the hospital were consumable as waste material, all could be incinerated near the point of use without return to a central point for disposal. Some hospitals have anguished public health authorities by disposing of waste in public dumps. Pulping could help, but not all residue can be flushed into the sewerage system. Most authorities agree that the high temperature incinerator is the best method for ultimate waste disposal.

3-144
LeTourneau, C.U. Nosocomial infections-part III. Hospital Management, 83(4):56-57+, Apr. 1957.

Because infected dressings carry heavy loads of infection, the Massachusetts Memorial Hospital provided"special septic sets"for changing dressings. Included was a wax paper bag for immediate disposal of soiled dressings. Used bags were placed in a closed container and incinerated.

3-145
Lewis, R.K. Handling empty compression cans. Hospitals, 38(16):36, Aug 16, 1964.

The safest disposal of compression cans is by puncturing before incineration or crushing. The National Safety Council recommended a specially constructed enclosed tool to provide protection for the person doing the puncturing.

3-146
Lewis, R.K. Just ahead: new standards in structures and equipment. Hospitals, 40(17):88-92, Sept. 1966.

Nursing unit incinerators, now available and used in England, allow immediate incineration of used dressings and other disposable fomites after removal from the patient, thus reducing bacteriological spread. Incinerating solid waste at nursing stations saves the labor costs now required for trash collection. "The cost of installation, operation, and maintenance of these units appears to be negligible compared to the labor savings that could result."

3-147
Lilly, E.S. The right equipment - key to solution of housekeeping labor problems. Hospitals, 43(18):74-76+, Sept. 16, 1969.

To meet the mounting problem of solid waste collection, storage, and disposal, the author describes the installation of a stationary packer system. All solid waste is placed in plastic bags, then carted to the compactor. To combat odors from the enclosed waste in the compactor and liquids draining from it, a nascent oxygen generator was installed. Pathological waste, stored in a walk-in freezer, periodically is removed for incineration in an approved incinerator.

3-148
Lippman, D.R. Improving a Hospital's Waste Disposal System. M.H.A. Thesis. Duke University, Durham, North Carolina, 1969. 36 p. [HU2008, Abstracts of Hospital Management Studies, Vol. VI, 1970].

Study defines alternative solutions to the waste disposal problems at the Moses H. Cone Memorial Hospital Greensboro, North Carolina, and recommends the most feasible solution in terms of economy and efficient use of manpower over a ten year period. Various new incinerators, renovation of the present incinerator, the use of pulperizer systems and compactors are among the solutions considered. A system combining two methods, incineration and compacting, is recommended as the most feasible method.

3-149
Loke, D. Ch.J. Refuse disposal in hospitals and other buildings. Instelling & Management (Den Haag), 2(1):25-28, Jan. 1970. [900, Hospital Abstracts, 10(6), 1970].

The author discusses the problems which arise in connection with waste disposal in hospitals: these include the collection, transport and final disposal of waste materials of all kinds, including disposables and infectious material which have their own special problems. He suggests that the use of waste disposal units would be advantageous. These can be sited where the waste is first produced (thus eliminating transport difficulties) and will grind and pulverize all types of waste so that it can be eliminated through the sewage system. This would save staff, be more hygienic and cost less than other methods of dealing with waste. Comments are appended from the (Netherlands) National Institute for Sewage Purification, and from the Department of Environmental Hygiene of the Ministry of Social Affairs and Health, criticizing the author's proposals from the points of view of sewage purification, hygiene and cost.

3-150
Loke, J. The Sluicemaster Plus reduces the danger of infection: a combined bedpan and dressing destruction unit removes pulverized waste by means of drainage. Technische Gids voor Ziekenhuis en Instelling (Amsterdam), 40(986):1261+, Dec. 13, 1971. [559, Hospital Abstracts, 12(4), 1972].

The Sluicemaster Plus combines a machine for pulping disposable bedpan linings and covers with one for pulping bandages and other disposable waste. The pulp is then passed into the hospital drainage system. The machine, which is described in detail, occupies 85 by 62 cm. of floor space. The cycle for the destruction of bedpan linings takes 140 seconds and that for bandages 30 to 40 seconds. Apart from savings in time and money the system is bacteriologically and hygienically advantageous.

3-151
Los Angeles hospitals can't dispose of all their disposables. Modern Hospital, 114(3):54, Mar. 1970.

The Los Angeles Board of Public Works recently placed a moratorium on its 1967 authorization allowing health care institutions to wet-grind disposable plastic and other solid waste materials for discharge to the municipal sewer system, because a study showed that ultimately the amount of disposables used in institutions could reach 300 tons daily, over 3 times what is now discharged to the sewers. Landfill disposal already is impossible because the county health department prohibits the transport of infectious materials through city streets. Currently incineration is being "re-evaluated" by the county's air pollution control district--most southern California hospitals burn infectious disposables now, but few permits are issued for new incinerator construction. The county hospital council has engaged a consulting firm "to modify existing incinerators, thereby reducing emissions from plastics".

3-152
MacInnes, J.W., and G. Palmer. Engineering in hospitals: refuse destructors. Hospital and Health Management (London), 9(107): 427-432, Oct. 1946.

The disposal method for a hospital's refuse will depend on the location and type of institution and the nature of the waste, some of which requires special disposal. Institutional waste can be composted, but burning is considered the best disposal method. Refuse composition varies, even seasonally, among institutions so that very wet, dry, and organic refuse often are incinerated together, however, wet refuse should be pre-dried in the incinerator. An ordinary destructor burns 20 lb. of refuse per square food of grate under natural draft, supplemented by forced draft (which increases the combustion rate) in larger units. In exceptional cases some heat from an incinerator can be used profitably by placing a nest of pipes filled with water in the path of the flue gases. The 1500 to 3000 BTU per lb. calorific value of refuse makes heat recovery "well worth efforts for the utilization". If waste heat is recovered, some means must assure relatively constant use of the boiler. Some incinerators, specially designed for hospitals, feature a large top door for feeding, a predrying hearth, and a secondary furnace for consuming obnoxious vapors. An additional small gas-fired incinerator usually receives waste from surgery and maternity. British institutions tend to install small gas-fired incinerators close to the waste source, preventing waste accumulation. Chutes were opening up a "field of interesting possibilities". Design must minimize fouling, provide for cleaning, preclude formation of obstructions, and provide ventilation. Methods for grinding refuse and discharging it to sewers were being developed, but none had yet been successful. Water consumption was "rather high".

3-153
Mallison, G.F. How do you dispose of "disposable" culture plates? Hospital Engineering Newsletter, 17(4):2-3, July-Aug. 1972.

The author recommends placing the plates in a pail of water and autoclaving at 250°F. for 20 to 40 minutes. Whatever liquid media is left in the pail after autoclaving can be washed down the drain, and the plates can be disposed of with other trash since they are no longer contaminated. An alternative would be to seal the plates in impervious plastic bags for transport to an incinerator.

3-154
Manual aids incinerator operation and maintenance. Hospitals, 43(2): 84, Jan. 1969.

An operator's manual prepared by the Incinerator Institute of America says that properly operated incinerators can attain nuisance-free emission of combustion products with little or no combustible residue. Improperly burned items cause smoke in violation of air pollution ordinances. The manual supplements manufacturer's instructions with common sense hints for operating a direct-fed destructor; double-flue, chute-fed incinerator; a single flue-fed by-pass incinerator; gas washing equipment; and a single-flue incinerator. Other hints discuss first time use and preventive maintenance (e.g., daily cleaning, lubrication, and keeping the incinerator room clean and well-lighted).

3-155
Manufacturing Chemists Association. Laboratory Waste Disposal Manual. Washington, Manufacturing Chemists Association, May 1970. 176 p. [8322, SWIRS].

The purpose of this manual is to assist laboratory personnel in developing an awareness of chemical hazards and in fulfilling their responsibilities to dispose of chemical wastes without personal hazardous adulteration of drains, and without excessive contamination of ground, air, or water. The manual stresses safe procedures for on-site waste disposal from small laboratories, especially those in small communities not possessing sophisticated equipment. Some 1200 chemicals are specifically listed in the manual. Disposal procedures are given by chemical classes. Treatment of hazardous chemical wastes, prior to disposal, are presented in basic outline form.

3-156
Maurer, A.H. Conditioning of waste for disposal. In Salkowski, M.D., ed. Disposal of Single-Use Items from Health Care Facilities; Report of the Second National Conference. September 23 and 24, 1970. Monograph No. 8. Ann Arbor, National Sanitation Foundation, Sept. 1970. p. 25-26. [15536, SWIRS].

Wastes generated in hospitals are usually collected in plastic or heavy duty bags, which act as liners in trash cans. The bags are tied and taken either manually or by the relatively new pneumatic chute system to a central collection point, where they are processed for disposition. The processing may take various forms: compactors to compress the waste; pulpers to chop the waste prior to flushing into sewage systems; incineration devices to burn wastes; or balers to prepare the waste for hauling. In attempting to determine the best handling for hospital wastes, it is necessary to evaluate capital investment, maintenance and utility operating costs, space requirements, manpower savings for both transportation and processing, benefit of volume reduction, haulage cost, and the ultimate nature of disposal. Two areas, though, which require further study are the definition of contaminated waste, and whether the sorting of solid wastes within the hospital is advantageous.

3-157
Mawson, C.A. Management of Radioactive Wastes. Princeton, D. Van Nostrand Company, Inc., 1965.196 p.

The reportedly small amount of radioactive material used as unsealed sources at hospitals includes a limited number of radionuclides, most with short half-lives, used in diagnosis and treatment. The special case of radioactive cadavers does not present a major problem of radionuclide transfer to the environment. Reasonable storage time generally was adequate for other wastes, permitting safe disposal by conventional means. However, release of radioactivity from a sealed source might require special disposal techniques. Because burial is an impractical disposal method for many hospitals, university laboratories, and research institutes located in developed areas, other disposal methods such as incineration, municipal refuse collection, or disposal into sewers must be used. Incineration generally is safe although the community might object to the discharge of even dilute radioactive emissions. Disposal at dumps is satisfactory if individual packages contain less than 10 mc of long-lived radionuclides.

3-158
May turn garbage into electricity: consultant. Modern Hospital, 109(4):214, Oct. 1967.

The article suggests that hospitals could generate electrical power from garbage and other solid wastes as already done in Munich, Germany. The increase in disposables has intensified the search for new waste disposal methods. Whereas the average American generates 5 lbs. of waste/day, the average hospital patient generates 20 lbs/day. The high cost of incineration, a popular disposal method, will become even higher as air pollution regulations require more controls. Hauling waste to landfills offers a good disposal method, yet cost is prohibitive if landfills are located too far from the hospital. However, the increased use of disposables, particularly paper goods, makes the heat content of waste the equivalent of soft coal so waste is a feasible power source.

3-159
Methods of waste disposal and questions in its connection. Staedtehygiene (Uelzen/Hamburg), 20(2):31-33, Feb. 1969. [11112, SWIRS].

The center for waste disposal in the federal Department of Health in West Germany recently issued a pamphlet which has been recommended to the various states to be accepted as guideline. This pamphlet is reprinted here. The wastes are divided into 20 categories ranging from domestic refuse, bulky waste, rubbish, hospital waste, industrial waste, various types of waste oil, car bodies, wastes from abattoirs, and manure to radio active waste, to name just the most important types. The disposal methods open to each type are indicated. For instance, domestic wastes can be dumped into sanitary landfills, composted or incinerated without preliminary treatment while bulky wastes must be crushed prior to composting or incineration. Hospital wastes may be incinerated only. Special regulations must be observed at the disposal of animal cadaver. Oily wastes or waste oil require special types of furnaces for incineration. If mixed with other wastes in a certain ratio they may be also composted. They also can be dumped on sanitary landfills. The latter disposal method is suitable for almost all wastes while only wastes rich in organic substances can be composted. Composting of domestic wastes generally yields between 40 and 80 percent by weight or 20 to 40 percent by volume of compost and 5 to 30 percent by weight of residual matter which must be dumped or incinerated. The investment costs amount to between 80 and 200 DM per ton of raw waste processed annually. The operating costs are between 4 and 25 DM per ton of raw waste. Proceeds from the sale of compost may bring up to 20 DM per ton of compost. Incineration of wastes usually yields slag, fly ash or gas. The residual matter may be dumped into a sanitary landfill. Investment costs here run between 100 and 500 DM per ton of annually processed raw waste. The operating costs (capital costs are not included) amount to 10 to 40 DM per ton of raw waste. The sale of heat may bring up to 16 DM per ton of incinerated waste. About 0.1 to 0.2 m^3/per capita and year of residual matter is to be expected.

3-160
Michaelsen, G.S., and A.F. Iglar. Disposing of disposables. Presented at Annual Meeting, American Hospital Association, Chicago, Aug. 21-24, 1967. 8 p. [67-0130, Solid Waste Management, 1967].

The disposal of disposable items is considered and the field of solid wastes and the hospital is surveyed. A study at one 1,100-bed hospital showed that the amount of predominately combustible packing material associated with use of syringes increased from 12 lb per year to 3,000 lb per year. A survey of 12 hospitals showed 127 disposable items used by various nursing services, 29 by dietary services, 24 used in surgical and obstetrical departments, 26 used by hospital laboratories, and 13 used by the housekeeping department. It is estimated that the heating value of hospital solid waste will reach from 2,500 Btu to 14,000 Btu per lb by 1975. Categories of hospital solid waste include garbage, combustible rubbish, non-combustible rubbish, radioactive waste, and biological material. The handling and disposal of solid wastes from the hospital is complicated by the possibility that seemingly innocuous wastes may include harmful componenets. Puncture wounds can be a serious threat to personnel who handle the solid wastes. Other wastes, characteristic of the hospital, are potentially contaminated and require special collection and disposal procedures. One example is radioactive waste. The waste collection system usually found in a hospital presents hazards. Since wastes are transported throughout the hospital, a possible route for spread of bacterial contamination is created. Disposal of solid waste on-site is commonly by grinding or incineration. Air pollution is frequently noted as a problem from hospital incinerators. It is concluded that there is relatively little known about hospital solid waste.

3-161

Mini-compactor's attack a maxi-problem. Executive Housekeeper, 3:68, Apr. 1971.

A Detroit hospital uses portable compactors, strategically placed on hospital wards, to reduce solid waste volume increasing due to disposables and now averaging 15 to 25 pounds per bed per day. The compactors eliminate storage containers, as well as require less time and labor for waste handling.

3-162

Mohr, O. The selection of incinerators for hospital use. Hospital Management, 85(2):118+, Feb. 1958.

After classifying incinerators suitable for hospital use according to feed method, use, size, and fuel, the author presents criteria for selecting incinerators. In certain cases capacity should be 8 lb/bed/day (5 lbs if garbage is hauled away), plus 3 lb/cap/day for residents and 1 lb/cap/day for outpatients. Reportedly operation normally was for 7 hours/day. Waste "fuels" in hospitals include rubbish (dry combustibles), mixed rubbish and garbage, garbage, human and animal remains, and pathological wastes. Special crematory and pathological waste incinerators are available. Flue fed incinerators are increasingly unacceptable, and auxiliary fuel is recommended for all hospital incinerators.

3-163

Montreal hospital saves 50% on container storage by use of compactor. Solid Wastes Management-Refuse Removal Journal, 14(5):32+, May 1971.

Although the amount of waste generated per day in the hospital continued to increase, the use of a stationary compactor reduced the volume of waste from eight to three cu. yds. per week. The hospital eventually replaced the compactor with a shredder-compactor which deposited the waste into a two cu. yd. container. This system is monitored by a control panel which can be adjusted for automatic operation.

3-164

Montreal hospitals--AHPQ protests sanitation report. Canadian Hospital (Toronto), 47(8):13-14, Aug. 1970.

A study of 26 hospitals conducted by the Montreal Health Department to determine incinerator modifications necessary to minimize consequent air pollution drew indignant protest from the Quebec Hospital Association. Two public health inspectors visiting each hospital noted inadequate waste disposal, sanitation, and hygiene practices in pathology rooms, kitchens, and laundries. The hospital association particularly objected to the health department's order that the hospitals modify or discontinue use of their incinerators within one week.

3-165
Moore, E.R., and B.M. Miller. Wet process pulping system gets rid of your hospital's disposal problems in a slurry. Modern Hospital, 117(3): 113-114, Sept. 1971. [18589, SWIRS].

The use of a wet-process pulping system in a hospital is described. The Wascon waste handling and disposal system was installed, in conjunction with the construction of a 256,000-sq-ft addition, which brought the institution to a capacity of 500 beds. The system is designed to reduce wastes to a fraction of its former volume. Waste is either fed into spiral chutes on the nursing floors and then transferred by gravity to the pulper, or it is carried in carts by housemen to the small 517-sq-ft room that houses the pulper, and then put into the disposal unit. Waste is fed into the pulper, where it enters a water tank. A high-speed rotating blade reduces the waste to a pulp suspended in water as a slurry. Solids such as glass are ground up and ejected through a special trash ejector on the side of the pulper. The slurry is pumped through 450 feet of 4-in. pipe to a water press. The water press removes water from the pulp and ejects it into trash bins in a moist, nondescript state suitable for landfill disposal. The system was modified by adding teeth to the impeller and a cutting mechanism was developed to increase the shredding action. The pulp is completely odorless. The system eliminated large concentrations of waste on the nursing floors and reduced the possibility of contamination problems. Pathological wastes are still burned.

3-166
Municipal incinerator installations offer most advantages to hospital. Technische Gids voor Ziekenhuis en Instelling (Amsterdam), 41(992): 207+, Mar. 1972. [847, Hospital Abstracts, 12(6), 1972].

A working party on the disposal of hospital waste has recently reported to the Netherlands hospital authorities. It recognizes six types of waste: (i) 'anatomical' waste from operating theatres and experimental laboratories; (ii) cadavers of experimental animals; (iii) grossly infected waste; (iv) waste from wards, out-patient departments, X-ray departments, laboratories, etc.; (v) normal domestic waste; and (vi) chemical waste from laboratories and pharmacies (not dealt with in the report). For all groups incineration is the disposal method of choice. Waste in groups (i) and (iii) should be destroyed in special small incinerators in the immediate vicinity. Groups (iv) and (v) can be destroyed away from the hospital, either within the hospital grounds, or at a central point serving several hospitals, or in the large municipal incinerators (the latter is by far the cheapest method). Except in very small hospitals it is not practicable to destroy all waste in the same incinerator. Transport of waste in groups (iv) and (v) should be in sealed plastic sacks and (outside the hospital) in specially designed trolleys. The working party also considered disposal by pulverization and elimination through the sewage system: this is not recommended for groups (i) to (iii) but is a possibility for other types of waste as long as proper precautions are taken. The working party estimates that before long the quantity of waste per bed/day will be as high as 2kg. for general hospitals, 3kg. for teaching hospitals, and 0.5kg. for psychiatric hospitals and nursing homes. Their estimates of costs (which are set out in a table) have been based on these estimates.

3-167
New incinerator for St. Thomas' Hospital. British Hospital Journal and Social Service Review (London), 82:1270, June 10, 1972.

Incineration was considered the only satisfactory method of disposing of the 2 1/2 tons of waste generated by this London hospital. Although the existing incinerator was recently installed, the high plastic content of the waste (about 20%) produced thick black smoke. Because of the low density of the waste, the incinerator did not have the cubic foot capacity to handle the volume of waste even though it had been correctly sized for the weight of waste. "This meant long hours of overtime working for the operators and since manual loading made the job both arduous and unpleasant, it was becoming increasingly difficult to recruit enough operators." A new incinerator with an automatic loader was installed which has solved both the pollution and operation problems.

3-168
New incinerator prevents air pollution. Modern Hospital, 112(3):158, Mar. 1969. [6832, SWIRS].

While federal air pollution codes call for a particle content not exceeding 0.2 to 0.3 grains/cu ft of released gases, the incinerator-like disposal system installed last year at Lutheran Hospital permits only 0.04 grains/cu ft to escape. Its patented pollution control principle is based on airdraft slowdown, which causes unburned particles to settle in the main chamber rather than to be released into the atmosphere. The 22,000 lb. unit consists of a cylindrical main combustion chamber with a smaller cylinder above for reburning gases, smoke and odors. Despite its bulk, the unit can be installed outdoors in an 18 x 10 ft area. The new type incinerator is initially fired by gas, after which the combustion process sustains itself on heated air. Electric thermocouples regulating the air flow provide a safety feature: if temperatures rise above the permissible level, the air is automatically shut off. Advantages are: lower cost, high efficiency, fast burning time, ease of maintainence, simplicity of operation, and reduction of residual ash content. Several hospitals throughout the country have followed suit.

3-169
New initiatives needed for disposing of hospital solid wastes. Solid Waste Report, 2(9):77, May 3, 1971.

Speakers at the American Medical Association's 8th Congress on Environmental Health emphasized the need for hospital management to accept new responsibilities in disposal of hazardous solid waste. Richard G. Bond, University of Minnesota School of Public Health, noted that only 39% of the hospitals with incinerators had specifically designated operators in charge--too often the incinerators are incapable of handling the wastes being generated and are managed by untrained operators. Furthermore, very few hospitals are equipped to meet new air pollution standards which should severly affect on-site incineration, particularly as hospitals seem to be losing their earlier immunity to local regulations. Bond recommended six ways for hospitals to accommodate environmental responsibility in their waste handling practices. John W. Greenleaf, Jr., of the Greenleaf/Telesca Consulting Firm, reported a study of solid waste management in seven hospitals for Los Angeles County. Greenleaf cited a need for new concepts in hospital waste management, suggesting that "everything coming from a hospital floor must be considered to be contaminated and should be classified as waste". Presently solid waste disposal costs over $3 per patient per day, with approximately 95% of the total cost attributed to labor for handling. Planning future "waste management systems for less than 40 lbs per day per bed patient may result in a seriously undersized system", Greenleaf said. He defended a properly designed and operated incinerator as the best and safest on-site processing method.

3-170
New refuse burner. Waste Trade World (London), 106(8):27, Feb. 20, 1965. [1640, SWIRS].

A new burner for general refuse with a charge capacity of 6 cu. ft. and a rating of 80 lb. of general refuse per hour, suitable for use in schools, supermarkets, small hospitals, and hotels, has been announced by A.B. Scorer Ltd. of Manchester. This latest development, called the Scorer C63, complies with the Clean Air Act through the provision of a water trough dust settling chamber and gas-fired afterburner or ignition burners capable of being fitted to suit the type of refuse. The fire bars are designed to give maximum cooling. If required, flame failure controls, electric pushbutton ignition, and timer control can be furnished. The one-eighth-inch MS plate casing is lined with 3-in. pre-cast refractory slabs. All furnace castings are made with heat-resistant cast iron. The 3,000 lb. incinerator is delivered to the site already assembled, although it can be supplied in sections where access is difficult.

3-171
New trade waste incinerator for Leamington Spa. Public Cleansing (London), 59(10):533-534, Oct. 1969. [7754, SWIRS].

The Royal Borough of Leamington Spa has contracted for the delivery and erection of an incinerator to dispose of trade and bulky waste. The unit is required to dispose of rubbish and refuse from trade and household premises at a minimum continued rate of 5 tons/day. Bulky wastes comes under three categories: (1) household tables, chests, wardrobes, mattresses, carpets, settees, etc., (2) trade and industrial wastes consisting of wet vegetables, meat, waste from cafes, restaurants, hotels, markets, together with rubber, plastics, tires, waxed wrapping papers and oily cotton wastes; and (3) small animal carcasses such as dogs and remains from veterinary centers and farms, together with organic wastes from hospitals, laboratories, etc. The complex will be provided with a split level site. The ash pit under the grate has been designed for easy access for cleaning out and has been sized so that the removal of ash is not necessary more often than once every four hours during the operation of the incinerator. The combustion chamber floor is of cast iron grate bars. Primary and secondary air supplied by a forced draught fan system is ducted to control burning conditions. The after burner is automatically controlled by smoke density equipment. The steel chimney is self-supporting with a total height of 65 ft.

3-172
Nonwovens are latest wave in the disposables sea. Modern Hospital, 111(4):136+, Oct. 1968. [6485, SWIRS].

Disposable patient bedding and apparel have been adopted in both special and routine applications in many hospitals. Theda Clark Memorial Hospital in Neenah, Wisconsin has a large modern incinerator only 60 ft from the laundry sorting room, where nonwoven fabrics are separated from conventional linens. Roosevelt Memorial Hospital in Chicago has an unsatisfactory incinerator which might be supplemented or replaced with haul-away trash disposal. General Hospital in Pontiac, Michigan expects to use a grinder plus a haul-away system to dispose of nonwoven sheets, pillow cases and gowns.

3-173
On waste disposers. Institutions, 59(4):224, Oct. 1966.

"The disposer is one of the most important kitchen items." Since food wastes generally are produced at multiple points, several smaller disposers save more labor than one large one. Additional general comments discuss the use of food waste disposers.

3-174
Ostertag, H., and W. Junghans. Use and elimination of disposable linen in hospitals and convalescent homes. Staedtehygiene (Uelzen/Hamburg), 16(10):213-218, Oct. 1965. [65-0209, Solid Waste Management, 1965].

Disposable linens and diapers are very reluctantly used because of the high costs involved. Their price is about 2 or 3 times as high as that of the conventional washable and re-usable linen. However they are more hygienic and they relieve the nurses of their most unpleasant work, especially since the introduction of Moltex diapers. The used disposable linens are collected in large paper bags, together with the other hospital wastes, and are incinerated. The danger of spreading infectious disease would be too great if they were dumped. The wet diapers and those containing excrements posed some incineration problems since they did not fully burn down. Experiments were done in a pyrometric cone incinerator to find a method which would thoroughly burn this type of waste. The full paper bags were loaded into the incinerator one by one at intervals of 1 to 3 minutes at a temperature of 800°C. The incineration process was observed through observation ports in the furnace wall. The waste burned down fully and the ash residues consisted only of metal and glass components. The construction of the furnace is described in detail.

3-175
Overton, W.J. New sources of energy. Modern Hospital, 48(6):87-90, June 1937.

Garbage returned on patient trays should be incinerated, rather than sold to pig farms. Heat could be recovered from waste incineration because a mixture of 65-70% garbage and 30-35% rubbish will produce 3000-3500 "heat units"/lb, and hospital refuse (about 7 lb/day/bed) reportedly is 40-50% garbage and the remainder, rubbish. Best incinerator efficiency is obtained by mixing dry and wet refuse. Prior to incineration, septic refuse must be stored to avoid direct contact by employees or rodent infestation.

3-176
Oviatt, V.R. How to dispose of disposables. Medical-Surgical Review, p. 57-61, Second quarter, 1969.

Stringent air quality standards face the medical facility with the problem of pre-testing waste material before any community system will accept the waste. The author briefly reviews incinerators, compactors, pulpers, wet grinders, shredders, crushers, and destruction ovens.

3-177
Oviatt, V.R. Status report: disposal of solid wastes. Hospitals, 42(24):73-76, Dec. 16, 1968. [1264, Hospital Abstracts, 9(8), 1969].

This paper reviews some methods of handling solid wastes and describes some current research projects. The handling of solid wastes causes public health and safety problems, radioactive wastes are a growing hazard, and disposable items now form a considerable portion of waste. A number of disposal systems are briefly described and these include: (i) packaging solid waste at its source; (ii) the standard trolley system; (iii) the gravity and pneumatic chute; and (iv) pulping. Research is now proceeding on a waste grinder handling all types of solid waste and able to grind biological wastes to be discharged directly to the sewer system. A second study is investigating the possibility of transporting domestic solid wastes through water carrying pipes.

3-178
Paine, H.L., Jr. The administrator and the atom. Hospital Administration Review, 2:12-13, May 1949.

Burial of radioactive waste is difficult for a city hospital because long-lived isotopes might be uncovered inadvertently. AEC recommendations include burial of discarded material liable to be contaminated, recording of burials, and periodic inspection of burial grounds.

3-179
Paul, R.C., Crush, flatten, burn or grind? The not-so-simple matter of disposal. Hospitals, 38(23):99-101+, Dec. 1964. [64-0752, Solid Waste Management, 1964].

In consideration of the relative merits of disposable versus reusables for hospital use, the problem of disposing of the disposables is often neglected. In a change-over to the volume use of disposable items, it is important that the plant engineer, the executive housekeeper, and the laundry manager work closely with nursing and purchasing to plan for changes in procedures and equipment. A picture is given of a disposal unit at the Baylor University Medical Center which crushes and flattens cans and bottles to reduce the volume of waste and permit more waste to be removed with each truck trip. A hydraulic packer is shown which compresses 100 cu yd of loose trash into 24 cu yd before incineration. A syringe crusher is shown which breaks disposable syringes so that they cannot be used in an unauthorized manner. It was found that when paper towels were supplied to each patient's room, an additional waste basket was required, the maintenance costs from plugged toilets increased, the labor charge for emptying and washing wastebaskets increased by 30 percent, but the volume of cloth towels did not decrease. Housekeeping departments have had to increase their trash handling facilities and personnel to keep up with the ever increasing amount of trash such as paper cups, pitchers, washcloths, bath mats, caps, towels, preoperative sets, etc. The incinerator load per patient per day has increased from 8 lb to 10 lb in the last few years. Pathological material should be burned in a separate unit for this purpose. The method of handling and ultimate disposal of disposable items should be planned in advance of their use.

3-180
Peddersen, R.B. Rather fight than switch? Hospitals, 46(20):132-137, Oct. 16, 1972.

Four years of experience of gradually replacing "from scratch" with convenience foods has saved a 201 bed psychiatric facility in New York more than $112,000 in food and labor costs. This switch is discussed in relation to the ten basic operational systems of a food service: procurement, storage, fabrication, prepreparation, preparation/processing, assembly, holding, service, cleanup, and sanitation. The author notes that the institution uses a paper bag garbage system, eliminating some porter work. Because the average patient stay is six months, limited single-use items have been adopted; however, even that minimal disposable serviceware "has increased the volume of solid waste almost to the breaking point."

3-181
Peimer, S.C. and H. Gothelf. A total disposables program. Hospitals, 39(9):45-48+, May 1, 1965.

Detroit's Sinai Hospital replaced reusables with disposables whenever possible. Despite the increased volume of refuse, additional disposal personnel were not required because the use of plastic can liners allowed more efficient collection. The incinerator, operated two shifts, could handle the increased waste load.

3-182
Peskin, L.C. The development of open pit incinerators for solid waste disposal. Journal Air Pollution Control Association, 16(10):550-551, Oct. 1966. [66-0365, Solid Waste Management, 1966].

A newly developed open pit incinerator originally developed for the safe disposal of chemical wastes is described. A cross-section sketch shows the essential features of the installation which has an open top with a system of closely spaced nozzles which direct a screen of high-velocity air over the burning zone at an angle of 30° to the horizontal. The nominal capacity of the incinerator is $3.4(10)^6$ Btu/hr per foot of length. Good results have been obtained with liquid and solid wastes such as wood, rubber, paints, synthetic fibers, and plastics. While visible smoke is readily eliminated and flyash can be readily contained by screening, no quantitative measurements of possible air pollution have been made. The device provides: use of the sky to absorb heat, simplified fuel handling, no grates needed with 100% overfire air, no need for skilled labor, no high maintenance, and low investment. In the burning, the only residual material was metal and ash particles. The device has a potential use in the incineration of bulk items found in municipal trash, the disposal of demolition lumber, and plastic materials which are increasing as a result of increasing use of disposable hospital items, such as syringes, culture dishes, tubes and other medical devices. Originally the device was developed for handling wastes where an explosion hazard would have existed in a conventional enclosed type of incinerator. This simple open pit incinerator offers a potential for many types of incineration.

3-183
Pioneering company began in 1856. Refuse Removal Journal, 10(9):12-13+, Sept. 1967. [67-0141, Solid Waste Management, 1967].

Dooley Bros., one of the largest haulers in the Boston area obtained its first refuse collection contract with the City of Boston in the late 1930's. The company now also holds a 5-year contract with the city of Somerville to remove the residues of its incinerator and other wastes. It is also engaged in other municipalities' household collections. Among its major commercial accounts are Boston University, Massachusetts Bay Transportation Authority, the footwear branch of B.F. Goodrich Co. and two hospitals, the Boston State and Beth Israel. In the two hospitals, stationary packers are employed. Even though their installation involved a comparatively high initial investment, they are now reducing pickup costs for the institutions by 25 to 30 percent. To handle the collection and removal of wastes in the amount produced at the present time, Dooley Bros. started with Dempster Dumpmaster units and front-end type containers. Then it acquired Leach rear-end loaders. It is now a distributor, through its equipment company, of Hercules Galion E-Z pack products. The number and capacity of incinerators presently operating in the Boston area is clearly insufficient. The major landfill site can continue to serve for a year or two at the most. Additional sites are not available in the Greater Boston area. Some refuse is burned at sea, but this method of disposal cannot be undertaken in rough seas or fog. A metropolitan commission is now charged with looking into the future and proposing solutions to the disposal problem, which is considerable.

3-184
Plassmann, E. Incineration equipment in the hospital. Krankenhaus Umschau (Kulmbach), 40(12):1138+, Dec. 1971. [560, Hospital Abstracts, 12(4), 1972].

An account is given of various types of incinerators, including those that make use of the heat produced. Statutory and other measures necessary to ensure safety, maintain hygiene and avoid pollution and noise are outlined. Analyses of the various types and weights of refuse produced in hospitals are given. Two photographs, nine diagrams and three tables are included.

3-185
Plastics add to problems of hospitals. Refuse News, 3(9):2+, Sept. 1970. [Abstracts, Excerpts, and Reviews, Vol. IV, 1971].

"The growing problems of disposal of hospital wastes has resulted in the formation of a special committee by the Hospital Council of Southern California to devise ways of handling the materials." A major problem comes from contaminated plastics. Plastic articles have become practically a necessity in modern hospital practice. The problem is especially acute in the Los Angeles area because of the need to incinerate the contaminated articles and the stringency of the air pollution regulations. The incident is given of a southland hospital that spent $35,000 on an incinerator only to find that the performance of the unit did not meet air pollution standards. The council authorized an expenditure of $20,000 for making necessary modifications of the offending incinerator.

3-186
Plastics pose a solid waste disposal problem. Environmental Science and Technology, 2:89, Feb. 1968. [Abstracts and Excerpts, Vol. I-II, 1968].

At present the disposal of plastics by incineration does not seriously affect the overall solid waste disposal problem according to a report prepared by the Battelle Memorial Institute for the Society of Plastics Industry, Inc. About 1.5 percent of the total wastes is in the form of plastics. This amounts to 3.25 billion pounds. The percentage may double in the next decade. However, if the amount of plastics subjected to incineration were increased significantly, plastic disposal could create a problem, particularly from hydrogen chloride and other hydrogen halides. The problem derives from the incineration of hydrogen-bearing plastics, such as polyvinyl chloride which accounts for one-third of the total plastics, and other polymers containing flame inhibitors. The concentration of HCl in incinerator stacks may approach toxicological limits under certain conditions.

3-187
Porterfield, J.D. An overview of problems and issues. In Brown, R.M., ed. Use and Disposal of Single-Use Items in Health Care Facilities. Monograph No. 6. Ann Arbor, National Sanitation Foundation, 1969. p. 25-27. [7545, SWIRS].

A general overview of the problems that are unique to hospitals in the area of single-use items are briefly discussed. Of vital concern to hospitals are fire, accidents, hazards of medication, hemorrhage, and cross-infection. Cross-infection is of primary concern, and care must be exercised against contamination. It behooves the hospital personnel to utilize every new development that improves the result, increases the efficiency, or meets any other one of the environmental factors. The adoption of better items may be in any of many fields from diagnostic and therapeutic paraphernalia, through the application of electronic data processing, to the improvements in myriads of supply items--such as the single-use items. One must consider the availability of the particular item, its suitability to the purpose intended, the receptivity of the hospital environment to the item, the acceptability of the item to the users, the relative economy of the item, its safety, and, finally, the disposal of the used item.

3-188
Pragay, D.A. Waste disposal in clinical laboratories. Clinical Chemistry, 18(6):594-595, June 1972.

To avoid "pouring pollution down [the] sink", the laboratory of a Buffalo, N.Y. hospital signed a contract with an industrial testing laboratory which takes care of the disposal of organic solvents, and arsenic- and cyanide-containing wastes. The author describes a process for reclamation of mercury from waste which can then be sold to an amalgram reclamation plant.

3-189
Preparing for increased refuse volume. Executive Housekeeper, 19(1): 78+, Feb. 1972.

A refuse compactor installed in 1967 in a 280-bed Wisconsin hospital should be adequate to meet anticipated increases in solid waste volume, according to the hospital's executive housekeeper. The unit consists of an indoor, hydraulic, motor-driven ram with a loading hopper which passes the compacted waste through the wall into an outdoor sealed 33 cubic yard container. The hospital calls the disposal contractors for pickup when the ram's pressure gauge indicates a near-capacity volume. As waste volume increases, the hospital "can either increase the frequency of pickups or order a larger container."

3-190
Problems of refuse disposal. Hospital and Health Management (London), 25:931-932, Oct. 1962.

Incineration is the most practical method of hospital waste disposal. The article discusses the design and operation of high temperature incinerators for general waste, pathological and infectious waste, and radioactive waste.

3-191
Product development report: mechanical food waste disposers. Institutional Feeding and Housing, 9:44-47, July 1957.

A general discussion of food waste disposers indicated that disposers usually are sized according to the horsepower of the machine's motor. Disposer problems include noise and vibration. Other machines such as peelers or dishwashers can be used jointly with disposers. Disposers require 2 to 10 gpm of water for 0.5 to 5 horsepower units. Drains should be 1.5 to 3 inches in diameter for the different sizes of disposers, and a grease trap should be considered. Disposal units generally cost $200 to $2000 depending on the size, in addition to installation costs of at least $300.

3-192
Providence fights pollution. Michigan Hospitals, 7:17, Nov. 1971.

A Michigan hospital switched to compaction from incineration of solid wastes at an increased cost of more than $5,000 annually in an effort to combat the air pollution consequences of incineration. Rather than the former 112 hours weekly of waste incineration, only biological wastes are incinerated for six hours per week. The compacted wastes are hauled to an official landfill area by a private contractor.

3-193
Rayner, H.M. On the disposal of disposables. Canadian Journal of Public Health (Toronto), 58(4):177-179, Apr. 1967. [67-0846, Solid Waste Management, 1967].

The rapidly increasing utilization of disposable items in all types of medical units has stimulated interest in methods for disposing of these items. Since many of the items are plastic (thermosetting and thermoplastic), one method of disposal is by incineration. Another method suggested is dissoluting of the plastic, which could then be flushed down a drain. In the latter case, it was shown that any "universal" solvent which might be developed would undoubtedly be toxic and also expensive, necessitating a closed circuit with solvent recovery and recycling. Other alternative methods of disposal include compaction (because most items are of low density) followed by sealing in impervious containers for collection by local authority refuse collectors, and the melting down of the medical items in special pans for subsequent removal to a specially-constructed incinerator for destruction. Whereas, the autnor does not criticize the use of 'disposables', he does warn that the "throw away" aspect is not as simple as it might appear to be.

3-194
Rayner, H.M. On the disposal of disposables. Journal of the Royal Army Medical Corps (London), 112(2):114-116, 1966. [1650, Hospital Abstracts, 6(10), 1966].

Disposable items are manufactured from plastics or from paper or glass-fibre bonded by plastic. Plastics may be divided into two main classes: thermosetting and thermoplastic. The former, used for tableware, cutlery, etc., present no difficulty in the incinerator since they first char then burn into carbon dioxide and water vapour so long as the temperature is sufficiently high. The thermoplastic group which are used for many purposes including bottles, stoppers, syringes, and the ubiquitous polythene bag melt in the incinerator and cause considerable problems. Those products containing a hydrochloric acid gas and carbonyl chloride (phosgene). The design of incinerators must provide for the melting of large masses of waste and the disposal of noxious gases. Other methods of disposal mentioned are those of crushing and concentration, the use of relatively low temperature ovens to melt the plastic, and of solvents to disolve the plastic materials.

3-195
Reavely, G.H. and P.G. Warwick. The disposal of infectious hospital waste. Hospital Administration in Canada (Don Mills, Ontario), 14(7):27-30, July, 1972. [1768, Hospital Abstracts, 12(12), 1972].

This is a summary of a detailed report submitted to the London (Ontario) Hospital Planning Council at the end of 1971. A study was made of waste disposal at eight hospitals with the object of determining the best method of dealing with infectious waste (defined as 'all substances which cannot be re-sterilized or re-used originating within, or brought into, patient care, laboratory or autopsy areas'). The amount of infectious waste varied between 5.2 pounds per patient day in the largest hospital and 1.6 pounds in a small hospital. After having considered in detail such alternative procedures as heat, steam and gas sterilization; composting; pyrolysis; grinding for disposal in sewage; and cobalt 60 sterilization, the authors recommend incineration on site as being safe and economic. Equipment would cost from $65 to $75 per bed and running costs would be between $22 and $28 per bed annually.

3-196
Rees, S.A.H. Refuse collection and incineration. Hospital Management, Planning, & Equipment (Sevenoaks), 29(361):419, July 1966. [124, Hospital Abstracts, 7(1), 1967].

The increasing size and complexity of hospitals produces a corresponding increase in the quantity of waste. Hospital refuse falls into three main categories: (i) that which can be burned, (ii) products with a re-sale value; and (iii) unburnable household refuse. Some of the considerations which govern the type and size of plant for the disposal of waste are discussed; a daily load for a hospital of 400 beds might amount to one ton and the nature of the refuse must determine the type of plant. The disposal of plastic materials is of increasing importance because they are not easily burnt. It is necessary for greater attention to be paid to the sale of scrap materials and the reclamation of paper.

3-197
Refuse and waste pose no problem in disposal. Modern Hospital, 72(3): 87-88, Mar. 1949.

"Disposal of hospital wastes presents no particular problem, a survey of the methods used in a group of small hospitals reveals. Commonly, wastes are collected in cans on hospital floors, then carried or carted, usually by the janitor, to a central disposal point and either burned in the hospital incinerator or picked up by a city collection service." Wastes are collected from one to three times per day. Supervision ("strict, constant, and centralized") is imperative in waste disposal.

3-198
Report of workshops I, II, and III. In Salkowski, M.D., ed. Disposal of Single-Use Items from Health Care Facilities; Report of the Second National Conference, Sept. 23 and 24, 1970. Monograph No. 8. Ann Arbor, National Sanitation Foundation, Sept. 1970. p. 33-38. [15539, SWIRS].

Three workshops were held after the conference to try to determine if any workable solutions existed for the problems presented earlier in the sessions. Recommendations were made concerning future studies and surveys. It was felt that a meaningful definition of the variety of hospital wastes should be created. This would facilitate disposal practices that require waste separation. It would also help in the creation of disposal equipment and in the establishment of total systems dealing with collection, storage, and transportation of wastes. It was stated that more of a burden should fall on the manufacturer; that is, producers should develop methods for recycling and/or ultimate disposal. Further, a continuing dialogue concerning solid waste disposal should go on between hospital administrators, government agencies, and manufacturers. Most of all, advantages and disadvantages should be carefully weighed with regard to methods of incineration, landfill, and wet grinding.

3-199
Reybrouck, G. and H. van de Voorde. The disposal of solid hospital waste. Hospitalia (Brussels), 14(3):145-155, 1970. [1194, Hospital Abstracts, 11(8), 1971].

The authors have made a study of the methods used to dispose of solid hospital waste, of problems in transporting it, in the reduction of its volume, and in the techniques of destruction. Refuse may be removed by the public services, or by special arrangement, or be destroyed on the hospital premises by incineration or crushing. Special attention has to be paid to health hazards. To ensure safety microbiologically, Belgium enforces legal restrictions requiring hospitals to burn soiled dressings. These regulations are, however, incomplete and not very specific. An enquiry was made among 110 non-university hospitals, from which 52 replies were received, as to the means of refuse disposal used. They mostly combined use of public services with incineration at the hospital. Infected dressings are burnt, and also flammable materials generally, including administrative waste. Other infected refuse, from laboratories for example, may be removed by public services. Kitchen waste is sold as pig swill. So far, modern techniques such as crushing machines are little used. More emphasis seems to be placed on keeping within the legal regulations than in ensuring hygiene. A list of 15 references is given.

3-200
Riches, H. Paper versus linen: some factors to be considered when comparing disposable and launderable products. Power Laundry + Cleaning News (London), 112(6):395, Mar. 12, 1965; 112(7):465, Mar. 26, 1965. [1463, Hospital Abstracts, 5(10), 1965].

Today there are about 200 separate diposable items available to hospitals, 30 of which replace articles which could be laundered. The introduction of disposable articles results in an increase of orders to the supplies department and a decrease in the articles sent for laundering. Consideration of the cost of disposables must take into account labour costs in purchasing, storing and disposing of items, so that a disposable towel, selling at 1/2 d. may in fact cost 2d. or 3d. It is unreasonable to compare the purchase price of a disposable item with the notional cost of laundering because laundering costs are worked out at a standard price per article. The very quality of disposability makes disposable items prone to misuse. Other aspects to consider in connection with disposables are reduction of infection and saving of nurses' time. Ward items such as bedpan covers, masks and incontinence pads can be destroyed at ward level incinerators costing between £100 and £150 to buy and install and £40 to £75 per annum to operate. Disposables which have to be collected and transported for destruction constitute the same infection risk as linen sent for laundering. Disposable bed linen has not in general been a success but polythene disposable draw sheets do away with the unpleasant task of washing contaminated macintosh sheets. Disposable uniforms and sacks are also considered from a launderer's point of view.

3-201
Riley gas or oil fired incinerator. Surveyor and Municipal Engineer (London), 124(3764):44, July 25, 1964. [64-0537, Solid Waste Management, 1964].

The Riley "Gaserator", a commercially available highly rated incinerator developed for the destruction of hospital and similar waste, is described, and the manufacturer's claims are listed. The device may be operated with gas or oil as auxiliary fuel to insure complete combustion of malodorous combustible gases. An installation in a 400 patient and staff general hospital consumes 580 lb of waste per hr with a gas consumption of 1,500 cu ft or 7.5 therms. General refuse, kitchen, and pathological waste, as well as dressings and material from the operating theatre, are included in the charge. There is no smoke emission and the residue of bottles and cans is completely sterile. The equipment occupies a ground area of 20 by 30 ft. The equipment is made in 10 sizes to burn from 300 to 6000 lb per 8 hr day. The equipment can handle waste products from factories which normally cause disposal problems. The basis of the operation is the injection of secondary air after the products of combustion has passed from the initial combustion chamber. This permits the destruction of all smoke producing elements.

3-202
Rising plastics content of wastes will pose problems. Chemical and Engineering News, p. 13, Jan. 8, 1968. [Abstracts and Excerpts, Vol. I-II, 1968].

About 3.25 billion lb of plastics per year are currently disposed of in municipal wastes. The plastic wastes consist of 38 percent polyethylene, 32 percent polyvinyl chloride, 21 percent polystyrene, and 9 percent others. By 1976, the plastics content of municipal wastes will be about 3.3 percent (9.5 billion lb per year). According to a study carried out by the Battelle Memorial Institute for the Society of the Plastics Industry, Inc., incineration of polyvinyl chloride and other halogen-containing plastics produces hydrogen halides that corrode incinerator parts and pollute the atmosphere. Intermittent sharp increases in plastics in wastes can clog incinerators. The corrosive nature of incineration products of plastics are relatively harmless to existing incinerators, but will become a problem in those in which water-cooled metal tubes are installed in the combustion chamber to recover heat, to permit higher combustion temperatures, and to give lower exit gas temperatures. The air pollution potential of hydrogen chloride and other hydrogen halides spell more trouble. Incinerating a typical refuse containing about 0.54 percent PVC yields a stack emission of 290 ppm HCl.

3-203
Rohr, F. Solving solid-waste handling problems. Actual Specifying Engineer, p. 88+, May 1972.

An engineer can develop an optimum system of material handling methods and equipment for in-hospital waste handling by establishing design criteria that consider public health, economic aspects, both existing and future conditions, and comparative analyses of alternative waste handling systems. For processing and ultimate disposal of waste, the author discusses incineration and on-site compaction, but suggests comparing the technical factors and capital and operating costs for each method before selection.

3-204
Rooen, W. The disposable dilemma. Canadian Hospital (Toronto), 45(10): 73-76, Oct. 1968.

The article lists benefits and disadvantages of disposables. Disadvantages include potential cross infection as a result of poor handling, the costs of handling and disposal, and possible air pollution. "In general, administrators agree that currently there is no real problem in disposing of single use items" which are thrown in the garbage, then sent to incinerators or specially designed ovens. Administrators say that problems can arise if a greater volume of disposables is used, requiring more manpower and equipment.

3-205
Rourke, A.J. Needed: safe way to destroy disposables. Modern Hospital, 109(3):132, Sept. 1971.

Dr. Rourke estimates that waste generation in hospitals has increased from 6-9 lbs/patient/day to 20 lbs/patient/day in the last 10 years. Although incineration is preferred for disposal, the increased volume also has increased pollution hazards. He discourages incineration in new hospitals and cautions those hospitals which are building with incineration to follow the most stringent building codes available. If central incineration is planned, sufficient storage area should be provided. He also recommends recycling.

3-206
Roving reporter: disposing of wastes. Modern Hospital, 87(2):12, Aug. 1956.

A California hospital uses a heavy duty grinder to dispose of placentae and other human tissues from maternity and surgery with discharge to a sewer line.

3-207
Rueckert, J.E. Trash Disposal Analysis. Wilmington, Delaware Hospital, 1965. 10 p. [HU2002, Abstracts of Hospital Management Studies, Vol. II, 1966].

Analysis of waste disposal systems for solution to problems of increased volume and overload of incinerator. "Somat" hydro-extractor method, hauling, small container hauling and compactor-container operations considered with cost factors and negative aspects reviewed. Recommendations derived from study include use of "somat" method, with other methods.

3-208
St. Vincent's tries new disposal system. Southern Hospitals, 39(8):11, Aug. 1971.

A Florida hospital is one of several across the country to install an automated, modular solid waste disposal system that reduces waste volume first by shredding, then by burning, to 1 1/2% of its original volume. In-hospital waste collection is by a pneumatic system that draws all unsorted wastes to an attrition mill that shreds, cuts, and breaks the material to 1/5 of its original volume; then air currents transfer the residue to a storage bin for subsequent burning. Because the waste is completely enclosed from the time it is deposited in the chutes, the waste never is exposed to air in the hospital or in the building's vicinity.

3-209
Salkowski, M.D., ed. Disposal of Single-Use Items from Health Care Facilities; Report of the Second National Conference, Sept. 23 and 24, 1970. Monograph No. 8. Ann Arbor, National Sanitation Foundation, Sept. 1970. 43p. [15530, SWIRS].

The Second National Conference on the Disposal of Single-Use Items from Health Care Facilities was conducted by the National Sanitation Foundation, a nonofficial, noncommercial voluntary organization concerned with man and his environment. Participants included interested groups of governmental health, health care facilities, and industry and waste management personnel. Recommendations resulting from the discussion at the conference included: a collaboration by the National Sanitation Foundation with manufacturers and suppliers to identify those characteristics which contribute to the problem of disposal; an assumption of leadership by the National Sanitation Foundation to promulgate criteria pertaining to the collection, handling, storing, and processing of wastes from health care facilities; a development of performance criteria for waste management systems and equipment; and an establishment of training programs for personnel involved in waste management. In addition, criteria are needed for the following three methods of disposal; incineration, landfill, and liquid waste processing.

3-210
Sanitary refuse disposal. Modern Hospital, 11(3):179, Sept. 1968. [7538, SWIRS].

A new device packs disposables into enclosed containers. A 350-bed hospital is experimenting with a new technique in sanitation refuse compaction, storage, and disposal. It is claimed that the new system replaced 4 of the 6, 10-yd refuse containers previously in service and drastically reduced burning loads in their gas-fired, four burner incinerator. The new compaction system, called The Power Mite, is a small hydraulic refuse stationary packer which can be hand loaded from ground level, from a dock, or placed under a trash chute. Depending on the density of the material, packing ratios of from 3 to 6 to 1 are achieved. When the refuse container is full, a truck-mounted handling unit picks up, hauls, empties, returns, and locks the container to the unit. One man and one truck do all of the work. Existing refuse containers can be modified to work with the new unit at a modest cost. The many advantages of the new unit are outlined and presented.

3-211
Schatzle, K.C. Trends in Solid Waste Handling in Medical Care Facilities. Ann Arbor, National Sanitation Foundation, 1970. 6 p. [18034, SWIRS].

The trend in medical care facilities is to replace the reuse of some facilities (e.g. needles, syringes) by the use of disposables. The weight of solid waste generated by patients per day in 1955 was 3 to 4 lb; in 1960 it was 5 to 10 lb; and in 1970 it was 15 to 20 lb. At present, the methods considered for handling solid wastes are: incineration, sanitary landfill, and grinding with discharge to a sewage treatment plant. Advantages and disadvantages of these systems are enumerated. At the Second National Conference on the Disposal of Single-use Items from Health Care Facilities, the following recommendations were made by manufacturers: a meaningful definition for the variety of wastes must be developed; close communication should be established between medical care administrators and regulatory agencies relating to the treatment and disposal of wastes; manufacturers should make an effort to facilitate the destructability of materials; criteria should be established for waste management systems to insure safety; and programs for training and education of personnel should be developed and implemented.

3-212
Schulz, W. Sewage disposal in infectious diseases hospitals. Sanitar und Heizungstechnik (Duesseldorf), 29(6):297-298, June 1964. [340, Hospital Abstracts, 7(2), 1967].

Sewage becomes a particularly serious source of infection when it comes from infectious diseases hospitals. The most recent German directions for dealing with dangerous sewage are those given in German Standard DIN 19520 of February 1964. The only process that meets all requirements is thermal disinfection but this, except when applied on a small scale, is too expensive for general use. The "Alinette" disinfecting plant, a diagram of which is given, has two alternately used containers in which the sewage is heated to 90°C., usually for one hour, and is then discharged to the drains after cooling to not above 35°C. If a heat recovery method is used, the amount of steam needed for heating is reduced by 90 percent and no cooling is required.

3-213
See new solutions to disposal problem. Modern Hospital, 115(2):148-150, Aug. 1970.

Waste disposal is a particularly critical problem for hospitals because: (1) disposable products are widely used; and (2) many hospital wastes considered infectious must be disposed of in a way specified by local regulations. A September 15, 1970 deadline to meet incinerator emission standards further complicated that problem for hospitals in Los Angeles County. That county already banned grinding of disposable materials for overtaxing the sewer systems and as a contamination threat. Furthermore, landfill disposal is precluded by county prohibition of infectious waste transport through public streets. Suggested solutions include: recycling and reclaiming, incineration of waste products, and sintering of residue to form aggregates for concrete. When purchasing disposable products, hospitals must evaluate what they consider a short-term convenience to determine the community's capability to accept that waste volume.

3-214
Siebert, G.W. Ground rules laid for burying radioactive wastes. Journal of Environmental Health, 32(6):656-662, May/June 1970. [8344, SWIRS].

There are two basic concepts in radioactive waste disposal. One is to attempt to completely contain the waste material and prevent it from spreading to the environment, and the other is to allow the radioactive material to enter into the environment in controlled and known concentrations. When radioactive material is buried whether it remains confined or dispersed depends entirely on the geology and hydrology of the burial site. When selecting an area as a site for a radioactive waste disposal facility, many factors have to be considered. The size of the burial site should be ample to meet the needs for at least 5 years. The site should also be a gentle relief for ease of operation of equipment and yet not be subject to flooding by surface water. The water table should be at least 5 ft below the floor of the excavatec burial trench. The ground water may convey radioactive contamination to surface streams; therefore, these points of ground water discharge must be established and the dilution capacity of the surface streams determined. Recommendation for trench construction and burial procedures are given. Radioactive waste should be segregated according to activity and hazard potential. Records should be maintained to reflect the source of the waste, isotopes involved, quantity of material, type of package, burial date, and activity. Each enclosed pit should be covered with an impermeable cover of clay or shale which has been compacted by tamping and this base covered with an asphalt cap. In order to minimize leaching and the subsequent migration of radioactive materials from the burial sites the principals of disposal operation are given.

3-215
Silverman, M. Will paper replace hospital linens? Hospital Topics, 42:28, Mar. 1964.

Disposables are here to stay, but adoption of a disposable item should depend on a complete evaluation of capital, handling, and disposal costs; patient safety and comfort; employee convenience, and sanitary features; as well as the advantages and disadvantages of the individual item. Disposal and storage are two major problems associated with disposables. The author suggests that "the most advantageous use of disposables is in the small hospital not equipped with its own laundry" or in using disposable items to supplement, rather than replace, linen inventories.

3-216
Small hospital questions: bacteria-laden wastes. Modern Hospital, 81(4):47, Oct. 1953.

The U.S. Veterans Administration specified that buried wastes from tuberculosis patients should have at least one foot of cover in a posted disposal area. However, incineration often is a preferred disposal method because land requirements are high for burying such waste. The Public Health Service recommends a supervised central incinerator for both garbage and sputum, affording better control for infectious wastes than small incinerators.

3-217
Small, R.E. Nonwoven disposables--past, present and future. Executive Housekeeper, 18(5):34+, June 1971.

Despite the social and economic value of nonwoven disposables, the increasing use, and consequent waste volume, of those materials present potential solid waste management problems. Disposable soft goods, primarily made of cellulosic materials, are compatible with all conventional waste management techniques. Yet industry recognizes that new methods of waste management, including recycling, will be desirable in the future.

3-218
Small waste incinerator for hospitals, schools and factories. Sanitar und Heizungstechnik (Dusseldorf), 32(11):847, Nov. 1967. [67-0623, Solid Waste Management, 1967].

An electrically operated incinerator had been developed by Saniguard Appliances Ltd. The unit can burn 45 liters of waste (e.g. paper, bandages, boxes, etc.) at a time. The operation is initiated by stepping on a pedal. The incineration cycle lasts at the most two hours. An adjustment to shorten the incineration period is possible. The unit is 102 cm. high, 55 cm. deep and 50 cm. broad. The waste is completely burned to sterile ash.

3-219
Snow, D.L. Environmental health services for medical research centers. Student Medicine, 9(3):256-262, Feb. 1961.

Disposal of solid wastes is one of several conspicuous problems. Improper solid wastes practices could cause nuisances or hazards to patients, staff, and community.

3-220
Snyder, H.J. Incineration as an Alternative for the Disposal of Hospital and Medical School Solid Wastes. M.S. Thesis. West Virginia University, Morgantown, W. Va., 1964. 87 p. [7296, SWIRS].

Medical centers with hospital and teaching and research sections produce a wide range of solid waste products. If adequate separation techniques are utilized, lower cost disposal methods can be used for non-pathogenic wastes, and more costly, controlled, on-site methods can be used for the pathogenic and contaminated material, as well as animal carcasses and human cadavers. Regardless of how well designed the incinerator and stack may be, proper operation is essential to avoid the emission of noxious gases and excessive particulates. An investigation was conducted at a modern medical center that utilized a general refuse incinerator and a general purpose incinerator converted to handle animal carcasses. The hospital general refuse incinerator emits excessive quantities of fly ash that affect cooling water towers and enter ventilating systems. The problem is due to a combination of inadequate incinerator design, poor operation, and insufficient stack height. The animal incinerator provides poor combustion of animal remains which results in the release of malodorous gases. The problem arises from a combination of inadequate gas burner capacity and charging too large an amount of waste to the incinerator. Grate alteration, additional burner capacity, properly designed water scrubbers, and increased stack height are the changes suggested. Standards should be established for the disposal of hospital and medical school solid waste, particularly for incinerator design and operation.

3-221
Solesbee, B.R. Cost Comparison: Nondisposable Surgical Packs Versus Disposable Surgical Packs. Richmond, Medical College of Virginia, 1970. 67 p. [PU3-5723, Abstracts of Hospital Management Studies, Vol. VIII, 1972].

Paper reports a preliminary study made at USAF Regional Hospital, Chanute Field, Illinois, to determine the feasibility of further investigation into the relative merits of disposable and non-disposable surgical packs. Information on disposable packs was obtained from a review of the literature, in an orientation trip to another Air Force hospital which uses the packs, and demonstrations of the items by three manufacturers. Five factors considered in the evaluation of disposable packs were: 1) Will they satisfy the same function as the reusable packs? 2) Will they improve patient care? 3) Will they be acceptable to the professional staff? 4) Will they save labor? 5) Will the disposal be economically feasible? Advantages and disadvantages of each system are enumerated and a cost comparison made. Main disadvantages of the disposable program was observed to be the requirement for more storage space and disposal capacity than the hospital could provide. However, on the basis of such expected positive results as reduction in number of personnel needed for processing packs, improvement of aseptic techniques and elimination of re-usable pack 1 laundry costs, it was concluded that the administration should continue the investigation to determine which system offers the most advantages.

3-222

Solid waste incinerator beats air pollution. Modern Power and Engineering, 66(6):48-49, June 1972. [21035, SWIRS].

The Ottawa General Hospital has replaced three older incinerators with a single new solid waste incinerator. Results have shown a drastic reduction in air pollution levels and a significant saving in waste hauling and disposal costs. The unit incorporates a Plibrico Duo-Flow incinerator capable of handling 1,750 cu ft of dry and pathological waste. Three burners provide complete combustion of the material. They are located in the primary chamber, anatomical hearth area, and the secondary combustion section. An operator loads waste in the primary chamber at the start of each cycle and seals the charging door. The operating cycle includes several steps. The afterburner switches on automatically to preheat the secondary combustion chamber to the required 1,800 F at 0.5 second retention time. Then the ignition burner starts and runs for 2 hr, during which just enough air for combustion is introduced. A secondary combustion section burns the material for 5 hr. An afterburner continues for 2 more hr, ensuring complete combustion of any particulate fly ash or smoke. When burning is complete, cooling air is brought into the primary chamber.

3-223

Solving the pollution problem faced by hospitals. Trustee, 24:9-12, Nov. 1971.

The hospital ideally should do nothing to endanger a community's environmental health balance, yet hospitals are faced with increasingly difficult solid waste disposal problems (e.g., disposables, needles and syringes) and increasingly restrictive disposal standards. Now hospitals are innovatively modifying traditional disposal methods to alleviate the pollution problems caused by solid waste disposal. The article discusses disposal innovations in incineration, compaction, and wet-pulping, but notes that the cost factors usually dictate incineration as the most economical method. Yet even incineration in compliance with air pollution regulations can be prohibitively expensive.

3-224
Stacey, J.M. Administrative reflections on disposables. Hospitals, 38(23):48-51, Dec. 1964.

More than 50 administrators of Virginia hospitals and numerous other administrators did not appear "overly concerned" about the problem of disposing of disposables, although a minority noted its additional cost. Although disposal problems should increase with increased use of disposable articles, disposal is not a significant concern to administrators today.

3-225
Steffes, F.J. and Floretta, J.F. Study shows most hospitals haul and dump, but compaction may be cheaper. Modern Hospital, 117(3):111-112, Sept. 1971.

A recent survey in the western United States concluded that on-site compaction and hauling may be the most economical method of final solid waste disposal in larger hospitals. Ultimate waste disposal, rather than internal collection, is considered a major hospital problem, particularly as the amount of disposable items in use increases. The study considered four methods of hospital solid waste management: hauling of unprocessed solid waste to a processing facility or land disposal site; on-site compaction with hauling; on-site incineration with hauling of residue; and pulping followed by hauling. On-site compaction and hauling provides a large reduction in operating costs attributed to reduced hauling charges, even when the initial capital expenditure is included. Annual direct costs of compaction, incineration, and pulping, estimated for a 400-bed hospital, are $17,000, $25,000 and $26,000 respectively. However, the definition and disposal of infectious waste still requires more study.

3-226
Stephens, C.M. Disposing of disposable bedpans and urinals: experiment with prototype machine at Ancoats Hospital. Nursing Mirror (London), 113:vii, Feb. 23, 1962.

Papier-mache bedpans and urinals, with contents, are deposited into a "Clinimatic Disposal Machine", and discharged ultimately into the sewer. Similar machines are expected to be used for disposal of other disposable articles in the future.

3-227
Sterling, M. Attitudes on the design of flue-fed incinerators. Journal of the Air Pollution Control Association, 10(2):110-113+, Apr. 1960.

The article reports results of a survey of equipment manufacturers and air pollution control officials. Sixty-nine percent of the respondents, including 71% of the responding air pollution control officers, considered flue-fed incinerators acceptable for hospital use. Those objecting said the flue-fed incinerator is "dangerous" for other than multiple-story residential dwellings and is inappropriate for hospital wastes because the incinerator is not of heavy duty design. In addition, hospital waste composition is more variable than that of residential occupancies.

3-228

Stormont, C.J. Disposable ware for patients food service. Hospital (London), 60(11):644-647, Nov. 1964. [552, Hospital Abstracts, 5(4), 1965].

An experiment in the use of disposable ware for food service was carried out at Acton Hospital. The disposables were made of paper, waxed and unwaxed, plastic coated paper board, aluminium foil, and plastic and expanded polystyrene material. They included the full range of plates, cups, beakers, bowls, knives, forks and spoons. Three wards (male geriatric, female surgical and children's) were selected, the total number of patients being 80. Each ward used the disposables for three weeks only. Observations are made on certain factors relating to disposable ware, as follows: (i) central storage; (ii) ward storage; (iii) dishing up and service of meals; (iv) incineration and disposal; and (v) reduction of noise; and on the advantages and disadvantages of the different types of disposable ware. Patients' views as given in 39 replies to questionnaires are summarized. It is concluded that the total use of disposable ware for food service is not at present wholly acceptable to patients. The cost for patients' catering alone would exceed £13,000 per annum for a 300-bed hospital. Partial use of disposable table ware would: reduce noise, ease acute staff shortages, shorten the working day in the central wash up, and simplify staffing arrangements. Provision must be made for storage and disposal.

3-229

Stubblefield, J.B., Jr. A Study to Determine the Most Up-To-Date Economical System of Waste Disposal for Hermann Hospital, Houston, Texas. M.H.A. Thesis. Baylor University, San Antonio, Texas, 1969. 67 p. [HU2009, Abstracts of Hospital Management Studies, Vol. VI, 1970].

Study showed that the present system of waste disposal at Hermann Hospital, Houston, Texas - a combination contract hauling system and 600-pound per hour incinerator - was cheap but inadequate. The pulping method, also investigated, was too new to be evaluated. The best method was judged to be a combination compactor-hauling system and the present incinerator, renovated to meet air pollution standards. It was recommended that this plan be implemented and that further study be made of the internal waste collection arrangements to determine a more economical and sanitary method than the one in use. Appendix contains diagrams and descriptions of the various disposal systems.

3-230
Swedish health official claims hospital waste disposal is unhygienic. Modern Hospital, 111(2):138, Aug. 1968.

Because over half of Sweden's hospitals discharge untreated wastes to the municipal sewerage systems, a Swedish county health officer charged Swedish hospitals with unhygienic waste disposal. Suggesting that hospitals study more carefully the composition (including chemical therapeutics, antibiotics, and radioactive substances) of the wastes to be released, the officer recommended state legislation for compulsory waste treatment.

3-231
The Swiss don't miss incinerator thrift. American City, 75:32, Feb. 1960. [Abstracts and Excerpts, Vol. I-II, 1968].

Recently in Berne, Switzerland, an incinerator was constructed which converts its waste heat into steam for use by two factories and a 1,200-bed general hospital, a 120-bed children's hospital, a dental institute, and a school. The plant burns 30,000 tons of refuse per year, and from this produces 30,000 tons to steam, resulting in an annual coal savings of 5,000 tons. Annual operating costs are 650,000 Swiss francs, wages are 360,000 francs, and income, mainly from the sale of heat, is about 560,000 francs.

3-232
Talens, P.G. Incineration. Pathological-waste incinerators. In Air Pollution Engineering Manual. Air Pollution Control District County of Los Angeles. Public Health Service Publication No. 999-AP-40. Cincinnati, National Center for Air Pollution Control, 1967. p. 460-471. [67-0546, Solid Waste Management, 1967].

Incinerators used for burning of pathological waste including organs, bones, muscles, other tissues, and organic waste are discussed along with crematory furnaces. Pathological waste incinerators can produce emissions of fly ash, smoke, gases, and odors that would be highly objectionable. A principal consideration in the design of pathological waste incinerators is provision for the release of fluids as the material is destroyed. Three general categories of design calculations are: combustion calculations, flow calculations, and dimensional calculations. Design of the ignition chamber, the secondary combustion zone stack and crematory is presented. A table outlines operating procedures for a crematory. An adaptation of the design for the retort-type multiple-chamber incinerator with three configuration differences may be used for pathological waste. The changes are: use of a solid hearth instead of grates, a provision for heating the hearth to evaporate fluids more rapidly and heat solid material lying there, and use of a side charging door. An illustrative problem shows a method for designing an incinerator.

3-233
Talton, R.L. Hazards and safeguards of aerosol dispensers. Executive Housekeeper, 11:50, Aug. 1965.

Nonflammable propellants used in aerosol dispenser cans may form toxic and corrosive gases when heated sufficiently. In addition, highly flammable propellants such as propane and isobutane have come into wide use. Solvents used in the aerosols may be flammable liquids such as alcohols, kerosenes, and "even flash petroleum distillates". Some gas or vapor can remain in a seemingly empty aerosol dispenser. An attendant at a village incinerator was blinded in one eye by a fragment from an exploding aerosol container. Used dispensers should be hauled away or buried, but never burned.

3-234
Tetreault, R.F., and E.J. Nieto. Should we use disposables? Hospital Management, 99(6):91-96, June 1965.

After considering pros and cons, a hospital introduced disposable needles and syringes for a trial period. The used syringes and needles were disposed of in special cardboard boxes provided near the point of use. The hospital engineering department and the city air pollution control agency indicated that incineration of the disposables would create no problems of smoke or residue. The experience suggested that disposal could be accomplished without difficulty at little or no additional cost.

3-235
Three hospitals upgrade incinerators to reduce air pollution by smoke. Hospital Administration in Canada (Don Mills, Ontario), 13(3):11, Mar. 1971.

At the request of the Ontario Department of Energy and Resources, three major hospitals in Hamilton, Ontario upgraded their incinerators by increasing internal temperatures to improve combustion of pathological wastes and reduce smoke emissions, and initiated a five-year program to adopt a low-sulphur fuel for the boilers.

3-236
Three year research study for Los Angeles high rise. Solid Wastes Management -- Refuse Removal Journal, 12(2):36, Feb. 1969. [11078, SWIRS].

A three year research program on solid waste practices in County-owned building complexes was initiated in Los Angeles. It's ultimate purpose is to determine new and improved solid waste handling and disposal techniques adaptable to various types of multistory buildings. Evaluations are being made in hospitals, five office buildings and three detention facilities. As a result, criteria applicable nationwide will be established for optimum solid waste handling and disposal systems and remedial measures will be recommended for the various types of facilities. The project is being performed in cooperation with the Solid Waste Program, National Center for Urban and Industrial Health, United States Public Health Service, Department of Health, Education and Welfare, which is partially funding the designated work plan.

3-237
To burn or not to burn: problems of waste disposal. Hospital Management, Planning, Building, Equipment, Supplies (Sevenoaks), 33(400):218-220, May/June 1970. [1683, Hospital Abstracts, 10(11), 1970].

The daily production by a 350-bed hospital of one and a quarter tons of soiled linen and a quarter ton each of dressings and food wastes is instanced as an example of the increasing problems of disposal both within and finally outside the hospital. Small ward incinerators are recommended for smaller items and the merits of various systems of bulk collection and delivery to a central point are evaluated. These include: (i) porters and sealed sacks; (ii) chutes, gravity and penumatic; and (iii) pulping. Outside contractor disposal is considered. Incineration plant installation is recommended, its successful use on a group basis in the Wolverhampton and Grimsby areas being described. Four types of incinerator, two sack units and a can-and-bottle crushing machine are illustrated.

3-238
Totting. British Medical Journal (London), 1:660, Mar. 15, 1969.

Health hazards caused by the uncontrolled salvage of material from solid waste are explored. Finding a new method for safe disposal of "medical" refuse is of particular interest. The ends should be broken off plastic syringes, then destroyed by incineration. Dangerous medical waste should be separated from ordinary domestic refuse for disposal.

3-239
Trash packer cuts labor costs at Ohio hospital. Modern Hospital, 106(5):214, May 1966.

Cleveland's University Hospitals take refuse to an on-site enclosed storage receptacle served by a hydraulic ram packing device. A 40 cubic yard detachable container is emptied three times per week. The device eliminated an unsightly refuse storage area and reduced the previous refuse handling schedule.

3-240
Trash removal. Executive Housekeeper 18:65, Feb. 1971.

A reader asked the question, "What is the preferred method for trash removal from institutions?" Rather than specifying a "preferred method", the answer states that many systems are highly acceptable and very workable including the compaction method, incinerators, garbage disposal units, and contract service pick-up with landfill disposal.

3-241
Tremari, A. Wet-waste transport and treatment systems. Actual Specifying Engineer, 27:83-88, May 1972.

The author defines wet-waste transport systems as "piping systems that transport wastes collected from various locations to a waste-handling or treatment facility or to the municipal sewer". The article discusses drainage and vent piping systems for hospital kitchens, laboratories (including disposal of biological wastes and low-level radioactive wastes, as well as decontamination of laboratory tools and glassware), and the hospital laundry. Although some hospitals also have tried grinding certain types of solid wastes into a slurry which also is discharged to the sewer system, "water pollution codes may prohibit use of wet-grinding systems in the future". If a municipal sanitary sewer system is not available, the hospital must construct and operate sewage treatment methods, pointing out that the various wastes should be separated and partially treated "at the points of general use, within the building before discharging into a municipal sewer or treatment plant".

3-242
Trigg, L.B. Engineer's forum. Hospital Engineering Newsletter, 12(1): 3, Jan. 1967.

In response to a reader's request for suggestions on how to keep trash and garbage containers clean, this plant engineer from a Texas hospital describes the compactor system which the hospital leases from an industrial disposal company. The 24 cu. yd. container is hauled three times per week and washed and sprayed with a disinfectant before being returned to the hospital. He also describes their water and steam garbage can washer.

3-243
Upmalis, A. Incineration in hospitals. Gesundheits-Ingenieur (Munich), 93(4):97-101, Apr. 1972. [87, Hospital Abstracts, 13(1), 1973].

In hospitals today, refuse is produced at the level of about four kg. per bed per day and the amount seems to be increasing. Much of the material may be difficult to burn since it may contain considerable quantities of moisture and plastics and, if animal experiments are undertaken, of cadavers and parts of animals. Corrosive gases may be produced during the combustion and hence mechanical grates made of resistant metal must be used. If the plant is suitably planned, some of the heat produced can be recovered. The design, operation and maintenance of a plant at a university hospital in Finland are described and reference is also made to details of plants used in France, Germany and Latvia. Four photographs and three diagrams are included.

3-244
Use your disposer properly. Institutions, 46(4):170, Apr. 1960.

Installation of disposers could improve sanitation, reduce odors, and free refuse can space for better use. Best operation would involve adding mixed wastes in a steady stream as they originate. However, the value of a disposer would be neutralized by letting wastes accumulate. Overload could result either from forcing too much waste through the unit at once or from an inadequate supply of water to the device.

3-245
Vaiana, S.J. Clean stack gas and reliable power. Power, 111(5):91, May 1967. [67-0551, Solid Waste Management, 1967].

Services connected to the emergency diesel generator, a caterpillar D-39, at St. Vincent's Hospital in New York City are discussed. Five thousand pounds of refuse per day are fed manually through chutes in the top of a Sargent incinerator. Hot gasses resulting from the burning of dry material, evaporate moisture from wet material entering through a separate chute. The afterburner raises the gas temperature to avoid condensation in the stack and a conspicuous plume at the outlet. A forced draft blower supplies air through tuyeres in the air-cooled sidewall. Hot gasses pass through four double sprays of water. While traveling downward through a gooseneck, the gasses drop out practically all their wet particulate matter before turning upward to enter the stack. Sludge is removed manually every day from the bottom of the shell containing the gooseneck. Operation of the burners, fan and watersprays is automatic. Impurities in the gasses leaving the stack are within limits imposed by Law 14 of the New York City Air Pollution Control Commission.

3-246
Vaughan, R.D. Management of solid wastes from hospitals--problems and technology. In Brown, R.M., ed. Use and Disposal of Single-Use Items in Health Care Facilities. Monograph No. 6. Ann Arbor, National Sanitation Foundation, 1969. p. 41-46. [6424, SWIRS].

Recent studies indicate that 19 lb. of solid wastes are generated daily for each hospital patient, while the corresponding per capita figure for the United States population is 5 lb. The 19 lb figure is even more significant when compared with a total of only 3.89 lb of solid waste per patient/day. Two reasons why disposable products have received such strong endorsement in hospitals is the role these play in control of infection and the economy involved. The use of disposables reduces demands on the central supply, but imposes a much greater workload on the receiving, storage, and waste disposal operations. Hospital incinerators must operate under increasing stringent air pollution control regulations. But whether the air pollution control device consists of a settling chamber, or liquid scrubber, they are not designed to prevent emission of pathogens. Adequate destruction of pathogens is only accomplished by sufficiently high temperatures, and air pollution control devices should never be viewed as a substitute for high-temperature destruction of pathogenic wastes. From seven to 10 percent of hospital wastes are not incinerable, and these, plus incinerator fly ash and residues, must be ultimately disposed of, such as by sanitary landfill. The Solid Wastes Program has performed considerable research in this process.

3-247
Vestal, A.J. The dilemma of disposables: helpful tips to consider. Hospital Topics, 45(8):87-89, Aug. 1967.

The disposal of disposables is not merely a matter of incineration, but a matter meriting careful analysis in all administrative aspects. Consequently, before introducing disposable items, the housekeeping department should consider the following questions: Will incineration problems arise? What happens to the disposable material in the incinerator? Are noxious gases produced? Is fly ash emission a problem? Are the existing trash chutes adequate for waste removal? How frequently do waste receptacles in patient areas need emptying? Are new receptacles needed.

3-248
The Victor 2, gas-fired incinerator. Smokeless Air (London), 34(129): 256, Spring 1964. [64-0555, Solid Waste Management, 1964].

The Victor 2, 1-2 cu. ft. incinerator, which will effectively destroy large loads of placenta, hospital dressings, ward waste, etc., is described. It is listed by the Gas Council as a recommended appliance complying with the Clean Air Act. To operate the incinerator, a foot pedal is depressed which opens the leading door to take the waste material, a dial is set to the required burning period, and the incinerator then operates automatically with a cutoff when the burning period has been completed. Two safeguards for reloading during burning are described.

3-249
Wallace, L.P. Disposables cause problems with solid waste disposal. Hospital Purchasing, 15:2-3, May 1971.

Two concerns that should influence decisions on the use of disposables are public health ("hospital waste and discards can breed epidemics and injuries and may contain drug-addictive material") and internal handling (problems include cross-contamination and increased handling costs). Through careful separation and incineration of infectious waste (about 30% of all waste) these problems can be minimized.

3-250
Wallace, R.T. The manufacturers' view-trends in development, marketing, and disposal. In Brown, R.M., ed. Use and Disposal of Single-Use Items in Health Care Facilities. Monograph No. 6. Ann Arbor, National Sanitation Foundation, 1969. p. 28-34. [SWIRS].

These trends in hospitals and health care facilities in regard to disposables are recognized: (1) in any given system area, each individual item needs to be considered for its best single-use size, package, and presentation; (2) several of these single-use items must be brought together into an optimum service package and the residual to be discarded; (3) to be truly economical, each system area being adapted to the disposable concept must go all the way to the supply and use of disposables. Only in this way can the full benefit of labor and handling savings be realized. The disposability of single-use items is a prominent problem. A difficult problem is created by the products, particularly in packaging, that combine two or more of the basic materials of glass, paper, plastics, and metals. These composite materials are created to maximize the specific function to be performed at the lowest cost, but it leads to significant complications in the disposable part of the cycle. A general conclusion is that single-use items for the various functions and systems within the health care environment should be directed toward disposal systems designed to return them to their original state in nature as rapidly as possible consistent with the best economics and protection of the environment.

3-251
Walsall Hospital Management Committee. Report on the use of disposables. Walsall, Walsall Hospital Management Committee, 1965. 22 p. [1464, Hospital Abstracts, 5(10), 1965].

This is the final report on the trial of disposables at Walsall General (Sister Dora) Hospital, which began in 1962. The report deals with the ordering of disposables, their issue, transportation, loading and unloading, storage, disposal and incineration, patients' reactions to their use, the opinions of medical and nursing staff, and cross infection. Costs, saving of time and labour and the effect of the use of disposables on laundry and central stores are also considered. Findings on individual disposable items are summarized.

3-252
Walter, C.W. Disposables, now and tomorrow: for the surgeon, many advantages, but still some problems. Hospitals, 38(23):69-70+, Dec. 1964. [64-0764, Solid Waste Management, 1964].

The advantages and disadvantages of using disposable supplies in the hospital are reviewed with emphasis on the intangibles. The disposable supplies are a benefit and convenience in the care of the patient and have the advantage of standardization. One of the main intangibles is faulty technique which may result in the sterile items becoming contaminated in use or in preparation for use. Getting rid of used disposables presents a problem because of bulk. Discarded needles and cutting edges are an occupational hazard to personnel. The combing of the dumping area by children for items of interest for play and various attempts to salvage materials and devices show that trauma and the spread of infectious disease are real hazards in the disposal of disposables. The safe disposal begins with the user who first discards the disposable. Infectious and radioactive materials and unused drugs must be discarded in containers for special processing. Cannulated needles must be broken and cutting edges protected and these items should be collected in containers that can be transported as is. The ultimate disposition by prompt incineration or by destruction and burial is the responsibility of the hospital. Lint from the careless disposal of paper and nonwoven products results in a serious problem. Following disintegration in washers, the short fibers coat the textiles and are thus spread throughout the hospital. Dressings and paper should be kept out of soiled linen. The successful use of disposables requires comprehensive and thorough training of personnel.

3-253
Walter, C.W. For the surgeon, many advantages, but still some problems. Hospitals, 38(23):69-70+, Dec. 1, 1964. [1007, Hospital Abstracts, 5(7), 1965].

Disposables are an undeniable benefit and convenience in the care of the patient. One of the attractive advantages is standardization of techniques and procedures, but standardization is distrusted by doctors. Experience has taught them that a rigid attitude develops which denies individual digression and that there is a strong tendency to maintain a standard until obsolescence occurs. The doctor has confidence in the quality and safety of disposable items distributed by reputable vendors, but there remain problems which are an increasing challenge: (i) ready availability leads to waste; (ii) disposal of used items; (iii) carelessly discarded needles and cutting edges are a hazard to staff; (iv) the hospital depending upon disposables sacrifices its self-sufficiency in times of disaster and civil strife; and (v) successful use of disposables depends upon careful selection of specific items and training programmes to assure proper and effective use.

3-254
Waste Disposal Arrangements. MAN-00-04-68. Victoria, British Columbia Hospital Insurance Serivce, 1968. 42 p. [HU2006, Abstracts of Hospital Management Studies, Vol. VI, 1970].

A pulping system combined with existing incinerator facility is shown to be preferable to a projected incinerator system based on the types of waste, procedures for processing and potential of air pollution.

3-255
Waste disposal: ecologists are worried, administrators aren't. Modern Nursing Home, 27(2):4-5+, Aug. 1971. [18587, SWIRS].

A poll of waste disposal problems in nursing homes was taken. A large number of respondents, 36 out of a total of 75, said society's new concern over environmental degradation has no effect on their disposal methods. Eleven administrators altered their disposal procedures due to awareness of environmental problems. The amount nursing homes actually spent on waste removal ranged from nothing to $5,000 a year. The poll indicated that disposable products may be contributing to the solid waste problems in some homes. Disposal methods vary in different parts of the country and from home to home. Most homes, 41, used municipal collection. Thirty-four administrators said they retained the services of private scavenger firms. Twenty-six used incinerators, two employed chemical disposal methods, and one used a compactor. Trash cans were the most commonly used containers, although the use of disposable bags was also common.

3-256
Waste disposal experts address Hospital Bureau. Modern Hospital, 116(4): 56, Apr. 1971.

Five federal and private environmental specialists discuss disposables, waste disposal methods, aerosol generation, and cooperative waste disposal units to service several hospitals. The panelists generally see the increased use of disposables as inevitable but emphasize that their use should be evaluated on the basis of patient care and economics.

3-257
Waste disposal in hospitals. Staedtehygiene (Uelzen/Hamburg), 15(3):78, Mar. 1964.

Hospitals are turning more and more to the use of paper bags for removing the accumulating waste. Both movable and stationary racks are available, into which the bags may be hung. The bags come in two sizes, 60/70 liter and 110/120 liter. Hospitals prefer the paper bags to sheet steel cans because they can be handled noiselessly and because they are more hygienic.

3-258
Weintraub, B.S. Community and regulatory considerations. In Salkowski, M.D., ed. Disposal of Single-Use Items from Health Care Facilities;Report of the Second National Conference, September 23 and 24, 1970. Monograph No. 8. Ann Arbor, National Sanitation Foundation, Sept. 1970. p. 29-32. [15538, SWIRS].

The communities and their agencies impose regulatory factors which affect waste handling and disposal. Sometimes the regulations cause almost insurmountable problems, especially for hospitals. An example of this situation occurred in Los Angeles, when medical institutions could not meet the stringent requirements set up by the Air Pollution Control District with regard to incinerators. The hospitals involved had to choose alternate methods of waste disposal and close down burning operations. One hospital chose to have its refuse hauled away, but later it discovered that contaminated wastes were affecting the underground water table; operations ceased. Another hospital installed what was thought to be the newest and most modern incinerator in the county, but the air pollution was still too high; the operation permit was denied. Several other hospitals experimented with grinding equipment and discharged the shredded, wastes into the sewage system; this however, proved to threaten the city's water reclamation plant with an overload, so the operation was halted. A complicating factor in all three methods tried was the separation of infectious agents from the solid waste. That is, all pathological specimens (blood elements, excreta, and secretions), fomites, surgical specimens, disposables such as dressings, and equipment used by patients with communicable diseases must be treated separately. The situation is not hopeless, though, and workable solutions to the solid waste problem will be found through diligent and patient effort.

3-259
Weintraub, B.S.,and H.D. Kern. Current status of hospital waste disposal. Executive Housekeeper, 19(1):20+, Feb. 1, 1972.

Strict air pollution control regulations preclude incineration, and disposal at a landfill poses the potential problem of ground water contamination. Wet grinding has proven feasible although only infectious wastes are ground so as not to overload the treatment facility. On-site sterilization if feasible would remove any possibility of disease spread and would eliminate the need for incineration. Pulping does not lend itself to hospital use because pulpers usually will not handle plastic, tubing, and similar inorganic materials, and the extracted pulp is heavy, often contaminated and not easily burned. Recycling is also feasible. Uniform criteria for waste collection, storage, transport and ultimate disposal are needed to eliminate overlap and entanglements between regulatory agencies.

3-260
Weintraub, B.S.,and H.D. Kern. Use of Wet Grinding Units for Disposal of Hospital Solid Wastes. Los Angeles, County of Los Angeles Health Dept., Aug. 1969. 168 p. [12504, SWIRS].

There is a pressing need for new methods of disposal of wastes from hospitals and related health care facilities. It has been determined that use of wet grinding units to dispose of these wastes directly into the sanitary sewer is entirely feasible, and, in many ways, desirable. Two hospitals in Los Angeles, California, one a 330-bed pediatric facility, the other a 96-bed general hospital, were chosen for a study. One grinder was installed in the can washing room of the smaller hospital; two grinders were installed in the larger facility. The experimental portion of the project lasted about one year. It was concluded that the installation of this method of disposal must be planned well in advance and tailored to the specific needs of the individual facility. Of primary importance are the water sources and accessibility of adequately sized sewer connections. Prior to initiating use of this system, there should be total inservice education of all staff personnel. The grinding unit selected for use must be large enough to accommodate the amount of material disposed. A large model similar to the 12-in. unit tested in the project would provide well for this type of disposal. In the study, there were no deleterious effects detected of ground solid wastes on the sanitary sewer. It is doubtful that the nature of the incoming sewage would significantly change should grinding of solid wastes be permitted. With an adequately sized disposal unit, there should be no limit to the amount or type of material which may be ground. There is a noise problem which must be considered when contemplating use of a large grinding system. Physical and microbiological aerosol generation from the unit is insignificant.

3-261
Weintraub, B.S., and H.D. Kern. Wet grinding units tested for disposal of hospital solid wastes. Journal of Environmental Health, 33(4):338-345, Jan.-Feb. 1971. [13761, SWIRS].

Since incineration and dumping are no longer effective means of disposing of hospital refuse, a new method of waste disposal is needed. A pilot study was carried out in Los Angeles, California, in two hospitals in which solid waste was shredded in wet grinding units and then emptied into the city sewerage system. The study evaluated the effect of ground solid waste on the hospital plumbing system, the effect of ground solid wastes on the sewage treatment facility, the types and quantities of hospital solid wastes that can be ground, the relative cost, the best location for the grinders, and any environmental problems that the grinders might cause. All equipment met Los Angeles City standards for waste disposal, although a permit from the health department was needed before the waste could be discharged. Results indicated that grinding of solid wastes into the sanitary sewer system presents an appealing solution to what has been a major public health problem.

3-262
West, R.F. The disposal of hospital refuse. The East African Medical Journal (Nairobi), 39(11):659, Nov. 1962. [383, Refuse Collection and Disposal, 1962-1963].

A general discussion of the disposal of hospital refuse. Incineration is found to be the most practical method. The article discusses basic design requirements of a hospital incinerator, special designs in hospital incinerators, universal and general-duty units, unusual problems in toxic waste disposal, and disposal of corrosive and radioactive wastes.

3-263
Wet grinding of disposables. Hospitals, 44(23):70-71+, Dec. 1, 1970.

The Los Angeles County Health Department conducted an 18-month study to determine the feasibility of using wet grinding units to discharge solid wastes directly from health care facilities into the sanitary sewer system. The authors conclude that "there should be no limit to the amount or type of materials that may be ground." Wet grinding is an appealing solution to the disposal problem, eliminating many handling, storage, transportation, air pollution, and other problems associated with current hospital waste disposal methods. Consequently, municipal agencies should reevaluate current restrictions on sewer discharge, possibly enacting "additional safeguards for pipeline crews servicing the system if the grinding method of disposal is used."

3-264
Wet process pulping system gets rid of your hospital's disposal problems in a slurry. Modern Hospital, 117(3):113-114, Sept. 1971.

The two-and-a-half year operating experience of wet process pulping system installed in the Decatur (Illinois) Memorial Hospital is described. Pathological waste is incinerated, food service waste is processed by a separate pulper, and the remaining solid waste is reduced to 20% of its original volume by a modified pulper. Initial operating difficulties required the installation of a new cutting device, a glass separator, and a make-up water system to reduce odors. The hospital officials now are convinced that the pulper will guarantee efficient general waste disposal without creating other environmental problems.

3-265
When is infectious waste not infectious waste? Hospitals, 46(9):56+, May 1, 1972. [21051, SWIRS].

The situation recently experienced by the Glendale (California) Adventist Hospital is indicative of the dilemma faced by a growing number of health institutions today. After having its brand new incinerator closed down, the hospital was told that neither sanitary landfills nor grinding to the sewers was permitted for infectious wastes. In desperation, the hospital applied to the Hospital Council of Southern

California for help. The council appointed a committee, which conducted a pilot study and promulgated the following conclusions. (1) It is possible to safely separate and collect infectious waste with a hospital. However, this separation does result in increased costs of waste handling. (2) The size of a hospital does affect the total number of pounds of waste per patient day, but it has very little effect on the number of pounds of infectious per patient day. (3) The composition of the infectious waste studies was as follows: paper--35.85 percent; hard plastic--11.42; soft plastic--7.09; cloth--10.33; wood--1.53; glass--17.93; metal--2.63; tissue--6.68; and other--6.54. (4) The average total waste from a patient day was 10.25 lb., but average infectious waste per patient day was 0.38 lb. In view of this very small percentage of total hospital waste that is infectious, the Los Angeles County sanitation districts, and later the City of Los Angeles, revised their regulations affecting infectious waste disposal. Now infectious wastes can be ground to sewage systems, and the remainder of the waste can be burned, provided the incinerator meets air pollution standards.

3-266
White, D.K. British hospital tests point to need for continuing evaluation: disposables. Hospitals, 38(23):52-58, Dec. 1, 1964.

Disposable papier-mache bedpans and urinal bottles are disposed of in a special machine costing $750. Other wastes (paper and dry wastes, soiled dressings, and other combustible used disposables, waste food, and broken glass) are placed in appropriate color-coded paper bags. Each ward found installation of its own electro incinerator useful to destroy waste as soon as produced.

3-267
White, D.K. Disposables in hospitals: an interim report on experience in the use of disposable goods on a large scale. Hospital (London), 60(2):89-96, Feb. 1964. [845, Hospital Abstracts, 4(6), 1964].

A 12-month experiment in the use of disposable products began at Acton Hospitals in April 1963 following a six-month pilot scheme in two wards at both the Royal Northern and Bedford General Hospital. Reasons for this investigation into the present and potential development of "single use" products were: (i) the recent rapid increase in professional demand and commercial supply; (ii) the need to evaluate the belief that the use of disposables could reduce cross infection and save time and possibly money; and (iii) this new field of supply has a great impact on the hospital's total organization, especially storage, distribution and disposal facilities. This interim report deals with the scope of the trials, consumption figures, assessment of the products, storage, distribution, disposal, bacteriological considerations, and time and money. The disposables being listed include uniforms and clothing, medical and surgical supplies, hardware and crockery, bedding and linen, and personal items such as individual bath mats and denture containers. A table sets out some examples of monthly consumption and cost.

3-268
White, D.K. Large-scale use of disposables: report of an 18-month experiment. Hospitals, 40(19):65-71, Oct. 1, 1966.

The results obtained from the study of over one-hundred disposable items at Acton Hospital, London, England, were described. The "disposal method of choice" for resulting wastes appeared to be incineration. "The responsibility for the safe, speedy, and effective disposal of soiled dressings and used disposables cannot be passed to the local authorities without the most stringent safeguards." Disposing of wastes in heat producing units was considered bad practice. "Consequently, small ward incinerators, one electric, and one gas, both about 1-1/4 cubic feet, were introduced and did an excellent job of reducing waste of all kinds (including rigid and soft plastics, disposable needles, and aluminum foil, provided that the proportion of those difficult materials represented no more than about 1/3 of the total load, a proportion very rarely exceeded in practice)." Until recently, small incinerators had been ". . . strictly limited in their capabilities. . .", but the progress in this field was "gratifying." Provision for incineration at ward or floor level was "worth considering" in planning future units.

3-269
White, D.K. Storage and disposal of disposables. Hospital & Management, Planning & Equipment (Sevenoaks), 28(345):229-230, Mar. 1965. [1465, Hospital Abstracts,5(10), 1965].

The King's Fund trials at Acton Hospital showed that 400 sq. feet of storage space in a hut nine feet high were adequate for 100 disposables, with an average stockholding period of four weeks. Storage problems can be considerably reduced by frequent delivery of the bulkiest items. Extra time for storekeeping and distribution through the use of disposables was 10 hours per week at a cost of approximately £150 per annum. Bulky items and disposable crockery presented the biggest problems; a marginal amount of storage was requied, but only bedpans, urinal bottles, crockery and cutlery needed to be distributed more often than once a week. The value of wall-mounted dispensing units for disposables is emphasized. Each hospital should have modern destructor equipment; Acton Hospital uses boilers at night for incineration, although this is not recommended, and one electric and one gas-fired incinerator are installed in two wards. Difficult materials such as disposable needles and aluminium foil can be easily destroyed if they do not form more than approximately 30 per cent of the load. Soiled and infected waste can be destroyed by ward incinerators as soon as possible and their annual fuel cost ranges from £40 to £75. Paper or polythene waste sacks should be marked in colour to show the destination and type of waste and special precautions are needed for disposable needles.

3-270
Who should pay for hospital solid waste disposal? Land Pollution Reporter, Freed Publishing Company, Sept.-Oct. 1969.

The quantity of solid waste generated in U.S. hospitals has increased from 3.89 lbs. per day in 1955 to 19 lbs. per patient per day in 1969 due largely to the increased use of disposable items. In recent years there has been a trend toward stricter regulations concerning the on-site handling of hospital wastes, in particular in terms of stricter air pollution controls on hospital incinerators. "Now, issues are also be raised concerning user charges to hospitals for the unusual burden which they may place on municipal disposal facilities."

3-271
Wieters, A.H. The sanitary engineer in hospital construction and maintenance. American Journal of Public Health, 38(6):770-774, June 1948.

The hospital must dispose of "ordinary" kitchen garbage and rubbish, as well as contaminated and infectious materials "peculiar to hospitals". The question is raised whether food left on plates by contagious patients should be fed to hogs.

3-272
Wilmarth, M.G. Disposables -- panacea or problem. Association of Operating Room Nurses Journal, 11:49-53, May 1970.

Disposables are a boon to the patient, operating room, and central supply but a headache to personnel charged with waste removal and disposal. One of the biggest problems and most important disposal methods to consider is incineration. Presently hospitals are unable to cope with this problem, which needs to be solved.

3-273
Wilson, F.W. Disposal of hospital waste by maceration. Hospital Engineering (Stevenage), 25:57-59, Mar./Apr. 1971.

This address by a British hospital engineer to the 1st International Congress of Hospital Engineering held in Rome in 1970 proposes that most hospital wastes can be macerated on-site into a slurry for discharge directly into the regular sewage system or into a special settlement tank. Because "waste disposed of as and where it occurs will achieve the greatest benefits," the author recommends maceration at points of generation. Disposal units can handle all types of hospital waste except metal and wire (which should be sorted and sold for salvage) and tin cans (which can be compressed and baled for haulage). Special machines are available for macerating disposable bedpans, urine bottles, and vomit bowls. If the local sewage system is not capable of handling macerated waste, hospitals should use a closed water system which transports the macerated slurry to a central extractor to remove the water and aerate the pulp for incineration or use as fertilizer.

3-274
Windman, A.L. Six systems available for treatment and disposal of solid waste. Hospital Management, 111(5):41, May 1971.

The author recommends several automated processing systems for hospital waste which include pulping and compaction systems, shredding with high or low ratio compaction, and a system combining shredding or pulping with incineration. He discourages hauling without processing because it "requires a great deal of storage room and the greatest amount of manual labor". "It also creates the dirtiest conditions and requires the greatest daily haulage."

3-275
Woodside, M.H. Eliminating a problem in the disposal of garbage. Hospitals, 23(5):71-75, May 1949.

The installation of garbage grinders offers a possible solution to the problem of garbage disposal if "installed on a decentralized basis as close as possible to the source of waste". Organisms of fecal and respiratory origin found in large numbers in garbage, although primarily nonpathogenic, "would indicate that any disease-producing bacteria usually discharged from the respiratory passages and gastro-intestinal tract might well be found to exist and multiply in garbage". According to estimates, garbage from one meal in a 30-bed ward could be ground in 10 minutes. If each patient generates 1/2-1 lb. of garbage daily, the increased sewage treatment costs for handling garbage ground and discharged to the sewer by a 300-bed hospital "should not exceed $50 per year". More efficient disposal possibly could reduce the 540 man-hours or $231.60 per month expended at Duke Hospital for garbage handling.

3-276
York, K.H. Disposables: Here to stay, but where? Modern Hospital, 102(3):120-122, Mar. 1964.

A prototype "masticator and macerator" was constructed to reduce storage space for used syringes and other disposables at nursing stations. Hazards to refuse collection personnel was reduced by such treatment of disposable syringes.

SECTION IV. MANAGEMENT IN GENERAL

4-001
American Hospital Association. Housekeeping Manual for Health Care Facilities. Chicago, American Hospital Association, 1966. 165 p. [HU0046, Abstracts of Hospital Management Studies, Vol. III, 1967].

A guide covering all phases of the foundation and maintenance of a good hospital housekeeping program. Included are sample procedures and schedules; appendices offer visual aids and a section on the chemistry of sanitation.

4-002
Bond, R.G. Sanitation and safety practices from a public health viewpoint. Hospitals, 27(8):102-106+, Aug. 1953.

Accumulations of refuse should be eliminated to prevent rodent infestation. In waste disposal, one needs "...an intimate and cooperative working relationship with the medical and nursing personnel so as to eliminate as much as possible the hazards of infection and contamination."

4-003
Bond, R.G., et al. Study of the Economics of Hospital Solid Waste Systems. Final report under grant no. EP-00458-02, Solid Waste Research Division, U.S. Environmental Protection Agency. Minneapolis, School of Public Health, University of Minnesota, 1973. 310 p.

This study develops a methodology for comparing hospital solid waste handling systems from a total system (collection, transport, treatment and disposal) point of view. Cost functions are developed for each alternative system with hospital characteristics as parameters in the functions. A discussion of the types and quantity of waste generated in hospitals is presented with emphasis on the affect of disposables. A model of a centralized incineration system is also developed.

4-004
Buxton, M.N. The world of disposables. Executive Housekeeper, 18(5): 20+, June 1971.

Disposal of the used product is the major problem in the use of disposables, even in small areas such as isolation rooms. An economic comparison of disposable and reusable items is based on the amounts of materials used, material cost, labor cost (including autoclaving and time to make up OR packs), laundry costs, and the cost of disposing of disposables. Disposables have tremendous value in convenience, patient safety, and other areas.

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4-005
Chaffee, F.W. Annual administrative reviews-hospital engineering. Hospitals, 39(7):81-82+, Apr. 1, 1965.

Waste disposal continues to present problems "whose solutions seem evasive." Satisfactory disposal of disposables requires more thinking. Many hospital incinerators contribute to air pollution. This has resulted in some return to trucking away wastes, as well as increased efforts to design incinerators for more complete combustion.

4-006
Checklist for evaluating disposables. Hospital Administration in Canada (Don Mills, Ontario), 9(9):14, Sept. 1967.

This report gives the hospital administration a checklist to help evaluate the advisability of using disposables instead of reusables. The list includes the following points: (1) How will the item be disposed of?; (2) Is there regard to safety factors for patient and user?; (3) Will the adoption of the disposable create another technique or procedure? and (4) In evaluating economics, be certain to consider costs of disposal facilities.

4-007
Clarisse, Sister M. Hospital hygiene: removal of waste. Texas Hospitals, 14:15+, Oct. 1958.

General hospitals produce an average of 7 lb. of waste per patient per day. Collection personnel should wear heavy gloves and route the trash carts away from food areas. The author gives a sample policy for waste removal. Although offices usually require waste collection only once a day, wards require collection twice a day. The author also noted the responsibility of non-housekeeping personnel for disposing of waste from operating rooms, laboratories, and the morgue.

4-008
Coan, N. Modern disposables - to use or not to use? Executive Housekeeper, 17(9):18+, Oct. 1970.

The introduction or increased use of disposables depends on performance-value, economics, user acceptance, inventory requirements, flammability, and disposal - all considerations which the author explores in depth. A cost analysis plan compares reusuables versus disposables.

4-009
Coffman, R.L. Faulty design, untrained personnel contribute to environmental hazards in smaller hospitals. Hospitals, 42(11):118+, June 1, 1968.

The author suggests that constructive assistance from official agencies, such as recent Board of Health action in Wyoming, can help small hospitals overcome environmental hazards resulting from poor design, insufficient planning of locations for equipment and supplies, inadequate training of personnel, as well as federal planning and requirements geared toward larger institutions. Typical hazards are laundry and trash chutes with consequent ambient air contamination, fire and smoke.

4-010
Collins, T.M. Legal aspects of pollution control. Hospitals, 46(20): 119-122+, Oct. 16, 1972.

To substantiate that the existing multiagency approach to pollution control requires that hospitals become familiar with both federal and state regulations, the author details the efforts of hospitals in Los Angeles County to reconcile their solid waste disposal problems with district and state restrictions. He concludes that a pressing need exists "for hospitals to acquaint themselves with the conflicts, if any, between regulations requiring specific methods of disposal of ill-defined types of wastes and those regulations that limit or qualify the type of effluent that can be discharged by specific methods of disposal." The hospital must evaluate the economic and environmental impact of its present and alternative waste disposal methods which comply with applicable standards, then actively support and sponsor "well balanced" legal efforts to improve the environment as a whole.

4-011
Cross, F.L., Jr., and G. Noble. Handbook on Hospital Solid Waste Management. Westport, Technomic Publishing Co., Inc., 1973. 170 p.

The authors bring together material presented in articles and reports on solid waste handling in hospitals. They discuss the quantity and types of waste generated, and describe in detail the advantages, disadvantages and costs of various collection, processing and disposal methods. They also discuss community influences on and future trends in hospital solid waste handling.

4-012
Davis, B.T. Use of disposable drapes. Hospital Management, 107(4
86+, Apr. 1969.

Conversion to disposable drapes represented a savings to the hospital in the sewing, laundering, autoclaving, and O.R. setup and cleanup times thus eliminating three staff positions. Twelve cubic feet of used disposables are incinerated each weekday, producing a small amount of grey, nontoxic smoke. The costs associated with disposal are not discussed.

4-013
Disposable syringes and needles. Journal of the American Medical Association, 191(1):47, Jan. 1965.

The writer suggested that disposable needles found by children in refuse may ultimately be used by narcotics addicts although the children first use them only as "water pistols". Reports from Illinois and New Jersey indicate that narcotics addicts have been using disposable needles found in hospital refuse. Public safety demands destruction of disposable needles and syringes as soon as possible after use.

4-014
Disposables are dangerous. Pennsylvania Medicine, 71(3):49, Mar. 1968. [68-0889, Solid Waste Management, 1968].

Doctor's used syringes and needles and drug samples present disposal problems: children can get them and use them as toys and others can injure themselves. The problem of drug dependence and addiction should not be compounded by improper disposal of medical supplies. Dangerous substances should be kept out of the trash can. A machine is available from surgical supply houses which will destroy a disposable needle. Another machine will crush a syringe. There are many other methods for proper disposal. If the institution is large enough to maintain an incinerator all these items can be burned. A jar of commercial acetone can be kept on hand and the syringe (or half of it) disposed of by dropping it in the jar. Needles can be "defused" with an inexpensive wire cutter.

4-015
Does a hospital pollute our environment. Sairaanhoitaja (Helsinki), 46:326-329, Apr. 25, 1970. [Editor's abstract].

Hospitals can be considered as health factories, but they are also living areas. In hospitals affect the same pollution factors as anywhere else in our society e.g. laundry, residue, sewage, heating. Furthermore, hospitals have their own special pollution sources.
In our article three hospital engineers, an isotope physicist, a nurse and a patient are sifting these sources. An ecological way of thinking of pollution is still unfamiliar in a hospital and conscious-

ness of the problems is lacking. Does a hospital pollute our environment? There are good reasons for this questions especially if our working millieu is a hospital that strives to factorylike effectivity.

4-016
ESCO/GREENLEAF. Solid Waste Handling and Disposal in Multistory Buildings and Hospitals. Final report under grant no. EC-00164, U.S. Environmental Protection Agency. Washington, U.S. Government Printing Office, 1972.

This study considers present alternatives available for refuse handling and disposal, identifies their advantages and disadvantages, and considers equipment under development to improve handling methods. The use of automated handling systems, such as pneumatic chutes and conveyors, is recommended for in-hospital handling and can "provide overall economy in annual operating costs". Problems with on-site treatment facilities are due to improper equipment and operation. Because of stricter air pollution codes, incineration even with sophisticated air pollution control devices cannot be recommended. Wet grinding and pulping of wastes with discharge to the sewer are two alternatives considered.

4-017
Feldman, E.B. A solution for waste collection and disposal. Executive Housekeeper, 17:22+, June 1970.

Rather than offer "a solution" for waste handling, the author surveys the subject to heighten current interest in this problem. He discusses containers and the efficacy of liners, collection methods (emphasizing manual collection methods, particularly the "exchange" method where the custodian exchanges an empty container for the full container which is delivered to a central dumping area), disposal (emphasizing physical removal by a contracting hauler), and compaction to minimize on-site storage space. Other factors an institution should consider in waste handling are cost, safety, pollution control, fire prevention, odor control, pest control, space utilization, esthetics, noise, salvage, scheduling, and sorting.

4-018
Gable, T.S.,and K.C. Schatzle. Water management of disposables in health care facilities. Executive Housekeeper, 19(4):76+, May 1972.

After briefly discussing the history of hospital solid waste volume, composition, and handling, the article details three methods of in-hospital waste collection and storage (bulk collection, compaction, and chutes), waste processing (compaction, pulping, shredding, and incineration), and ultimate disposal by sanitary landfill, liquid waste disposal (via the community's sanitary sewerage system), or incineration. The complexity of the waste and potential pollution problems makes it "doubtful that any one single system or method will accommodate this range of materials".

4-019
Gohr, F. Fundamentals of administration. Hospitals, 46(20):65-66+, Oct. 16, 1972.

Recognizing the increasingly broad, varied, and often technical problems posed by the hosptial environment, administrators must be motivated to solve the problems, then assess and solve those problems within the hospital's fiscal and manpower limitations. The author identifies and discusses five steps essential to the administration of environmental health and safety programs as: (1) Identification of the problem; (2) Evaluation of the problem; (3) Recommendations for solutions; (4) Corrective action; and (5) Reevaluation to ensure that the problem is solved. Responsibility for implementation of environmental programs exists at the policy level in a statement by a top management executive, at the administrative level (including the administrator and department heads), and at the operational level where supervisors and employees execute activities within established procedures. Needed consultation should be sought from both public health agencies and private consultants, yet environmental programs are most successful when administered from within the hospital.

4-020
Graham, K.D. Hospitals and ecology? It pays!!! Hospital Forum, 15:9-10, Sept. 1972.

In October, 1971 a California hospital initiated a recycling program which has expanded to include glass, tin cans, aluminum, computer data cards, and cardboard. The original program required no capital investment and earned $45 monthly from glass, tin cans, and computer cards. After seven months the hospital purchased a bailer to facilitate recycling cardboard, increasing revenues to $85 monthly. The bailer will pay for itself in three years while offsetting costs for transportation and storage bins. Moreover, the program has succeeded in its goal to reduce incineration time from 6-8 hours daily to just 20-40 minutes per day.

4-021
Gray. A. The new surgical block. The Surveyor (London), 116(3417):1086-1088, Oct. 1957.

The new "surgical block" for Guy's Hospital, London, features two elevators for removing soiled linen and wastes from wards and operating theaters. Associated with each ward was an area where soiled linen, waste, and garbage were stored until transfer to a collecting room on the lower ground floor for disposal. Gas-operated dressing incinerators are located on each ward floor, and two large incinerators on the lower ground floor handle wastes received in the refuse handling areas.

4-022
Gunn, T. Material Movement Systems Analysis. Ann Arbor, Chi Systems, Inc., Oct. 1971. 645 p.

This report concerns the design of a complete materials movement system for the McMaster University Medical Center in Hamilton, Ontario, Canada. The section on waste handling contains a detailed analysis of the quantity of waste generated from various areas in the Medical Center. The Medical Center generates about 38 lbs. per patient per day overall. The report recommends the use of a motorized cart conveyor which can be driven throughout the Medical Center to collect waste contained in plastic liners. Filled carts are brought to the garbage room where they are automatically dumped into a compactor. A separate system for handling pathological waste is described, and equipment and operational costs are estimated for the entire waste handling system.

4-023
Handling of Materials in the Kelowna General Hospital. Victoria, Hospital Consultation and Inspection Division, British Columbia Insurance Service, 1970. 43 p. [PU3-6650, Abstracts of Hospital Management Studies, Vol. VIII, 1972].

Reports a 1969 study of the materials handling procedures at Kelowna General Hospital (British Columbia) for the purpose of devising a total system compatible with the phased completion of a projected construction program. An analysis of the mechanical subsystems (pneumatic tube and conveyor) used for the receipt, dispatch and distribution of all materials and supplies and the disposal of waste indicated that each one fulfilled a specific need, although supplementary manual transportation was necessary. Details of procedures for the movement of materials and supplies such as orthopedic equipment, specimens, mail, linen and furniture are discussed. Major recommendations were for: 1) establishment of a Central Dispatch Service with its personnel forming part of the Central Stores organization under a Materials Manager, and 2) centralization of procurement, receipt, storage and distribution of materials and supplies under Central Stores. Appendix contains floor plans and diagrams of materials handling systems.

4-024
Herdman, W.E. Uniform health codes for hospital wastes. Progressive Architecture, 53:106, Nov. 1972.

The lack of uniformity in hospital waste handling demands a national health organization to begin a responsible effort to assist health departments in formulating standard hospital waste disposal methods. Currently most state health codes require special handling of pathological wastes; however, much less consensus exists about handling animal wastes and bedding, laboratory wastes, or general hospital wastes, although the trend is toward incineration of all hospital wastes. Consequently the Federal government is defining the different types of hospital wastes and developing waste handling guidelines that states should incorporate in the form of health codes according to the state's unique geography, topography, demography, economy, and other variables. The health codes will vary, but should concur in many areas directly relating to hospitals where waste is identical. State standards can be more stringent than Federal guidelines and should clearly delineate operational responsibility to avoid direct conflict in regulation by state agencies.

4-025
Herrmann, F.N. Materials management. Hospitals, 44(7):117-120, Apr. 1, 1970.

The greatly increased numbers and types of products used in hospitals have caused the purchasing agent to accept an expanded role as materials manager. One major problem confronting him is waste disposal, largely of disposable products. The author discusses the solid waste handling methods which increase in cost as disposables increase waste. The materials manager must continue to contain expenses without reducing the quality of service provided.

4-026
Horty, J.F. Courts rule on unlicensed doctors, hazardous wastes and claims priorities. Modern Hospital, 112(4):56+, Apr. 1969.

In a New York case, the court found a hospital negligent in the burning of a sanitation department employee when a sulphuric acid bottle from the waste load fell on him. The hospital's maintenance procedures provided for disposal of acids into the sewer system. The court ruled that a hospital should have effective maintenance and disposal procedures for anything of danger to the general public or people on hospital premises.

4-027
Hospitals' growing waste piles won't self-destruct. Hospital Topics, 50:22-24+, May 1972.

Reports on solid waste handling in hospitals are quoted extensively in the article to show the many problems faced by hospitals in the disposal of their solid waste. The potential for contamination due to improper waste handling within the hospital, the pollution problems due to faulty treatment equipment and improper operation, the trend toward more stringent regulations on the means of disposal, and the problems faced in handling infectious, radioactive and hazardous waste are discussed. The disposal methods employed by several hospitals are presented.

4-028
Iglar, A.F. Solid wastes and the hospital. Presented at the Training Course "The Sanitarian and the Control of the Hospital Environment," Wheaton, Ill., Feb. 6-10, 1967. Minneapolis, University of Minnesota, School of Public Health, 1967. 12 p. [8722, SWIRS].

Solid wastes from hospitals are responsible for an important, although small, part of the total solid waste generated. At Minnesota's University Hospitals, partial surveys for solid wastes showed almost 9 lb/patient/day with a per patient volume of about 3 cu ft/day. At University Hospitals, the operating room areas generated approximately 5 percent of the total wastes measured. Clinical laboratories generate large amounts of waste, much of which is contaminated. Considerable biological material is disposed of by a pathology department. The use of radioactive materials in hospitals deserves consideration; generally, the radioactive solid wastes are stored until natural decay results in a diminishing of activity. Refuse chutes are a controversial item in refuse handling in the hospital. A major problem is that chutes for hospital refuse can allow vertical airborne transmission of any pathogens in the refuse. Hospital incinerators include flue-fed units, which are especially likely to cause nuisance. Removal of solid waste from hospitals may be accomplished by hauling by a private contractor or by the hospital. Possible problems in hauling include flies, odors, and poor appearance.

4-029
Iglar, A.F.,and R.G. Bond. Hospital Solid Waste Disposal in Community Facilities. Final Report. Minneapolis, School of Public Health, University of Minnesota, May 1971. 332 p. [18306, SWIRS].

Research in the generation of solid waste in hospitals was performed in three stages: an initial orientation study at 7 hospitals, a second stage at 25 selected hospitals, and a full-scale study at 80 hospitals throughout the nation. The second and full-scale stages were conducted in nongovernmental, nonprofit, general hospitals with 50 or more adult beds. The communities where the hospitals were located were in standard metropolitan statistical areas in 60 percent of the cases. Collection of waste, storage, incineration, grinding, treatment of biological and radioactive material, and that of needles and syringes, were all investigated. The waste hauled away from the hospitals and the manner of its disposal were looked into. Data were collected for quantity generated per patient per day and quantity per admission. Its composition and source of generation were noted and the collection and disposal operations described. An analysis for the data resulted in a number of significant correlations which should have a meaningful bearing on future surveys. As a result of the observations gathered in this investigation, a number of recommendations are made in order to improve the safety measures in handling solid waste in hospitals.

4-030
Jain, J.L., S.R. Arora, and R.G. Bond. Integrated approach eliminates waste. Hospitals, 46(20):105-108+, Oct. 16, 1972.

Because many problems of hospital solid waste handling result from the failure to organize an integrated waste handling system, the authors designed a "decision tree" to guide hospital management in evaluating a total system that encompasses the complete handling, processing, and disposal of solid waste and includes both labeled costs and the unlabeled costs to the community. The decision process of an integrated approach requires: (1) Identifying various functions involved in complete waste handling systems; (2) Developing alternatives to accomplish those functions; (3) Prescribing acceptable service standards for all phases of waste handling; (4) Developing cost functions for the alternatives; and (5) Evaluating the composite systems to select an optimal system. The four major functions involved in waste handling (a main internal collection system, treatment at the hospital, final disposal, and transportation) form "nodes" on the decision tree, from which branch out the alternatives available at each of those decision points. The development of standards (considering noise, odors, safety, esthetics, fire hazards, sanitation, and infection hazards) and cost functions (based on fixed capital cost and operating cost) leads to evaluation of the alternative systems and selection of an optimal design for a given situation.

4-031
Kalin, M. Incinerator safety rules. Executive Housekeeper, 18(8): 160, Sept. 1971.

Incinerator operators must be oriented, trained, and supervised in the safe and proper use of incinerators as well as potential hazards such as flashbacks, overloading, and the combustion of oily rags, bottles, or pressurized cans. The author lists six safety procedures the incinerator operator should follow.

4-032
Kemp, L.A.W. Transistorized, battery-operated "door-post" radiation alarm monitor, with audible and visual warnings. Acta Radiologica: Therapy, Physics, Biology (Stockholm), 8:433-438, Oct. 1969.

The London Hospital installed a number of gas-fired incinerators in individual wards to handle soiled dressings and other combustible waste. The main hospital incinerator was equipped with radiation monitoring devices, and in order to prevent the incineration of radioactive materials in the ward incinerators, which posed potentially serious consequences, radiation monitors were installed on each incinerator. The monitors are described in detail.

4-033
Koren, H. Role of the sanitation officer in promoting environmental health. Hospitals, 39(8):118-121, Oct. 16, 1965. [HU0016, Abstracts of Hospital Management Studies, Vol. II, 1966].

The author describes the philosophy and purpose of the sanitation officer at the Philadelphia General Hospital, whose work cuts across departmental lines and who is directly responsible to the executive director of the hospital. He summarizes progress made in several areas, including insect and rodent control, waste disposal, therapeutic baths and swimming pools, ice sanitation, food sanitation, housekeeping, and hospital-acquired infections.

4-034
Laudenslager, A. The subject is disposables. Hospital Forum, 7(9): 14-16+, Dec. 1969. [Abstracts of Hospital Management Studies, Vol. VII, 1971].

Advantages and disadvantages in use of a disposable ware system for hospitals is discussed along with problems of introduction, including disposal and disposables and the transportation of meals. Author concludes disposables should definitely be used, particularly because of cost savings, but only after careful planning and testing.

4-035
Litsky, W., J.W. Martin, and B.Y. Litsky. Solid waste: a hospital dilemna. American Journal of Nursing, 72(10):1841-1847, Oct. 1972.

The average hospital patient generates 24 lbs of waste per day, compared to 6 lbs/day in 1955 and 19 lb/day in 1965. The increase is due to the increased use of disposables. Because "everything that touches a patient is a potential public health hazard," all wastes (particularly pathological wastes from the labs, surgery, and other sources) should be handled with caution. The article discusses three methods of in-hospital waste transport (by cart, gravity chute, or pneumatic chute), concluding that the pneumatic chute's design flexibility and continuous filtering of the air within the system "is the most logical and safe method." After discussing several methods of waste disposal, the authors recommend incineration of all wastes. Specifically, the authors recommend that "all pathological, surgical, and laboratory waste products should be sterilized by autoclave at the in-hospital source." After sterilization, all wastes should be compacted under laminar airflow to minimize the possibility of microbial contamination of the environment by hazardous materials. Ultimately all waste should be incinerated at properly installed and operated incinerators equipped with "adequate" air pollution control devices, an expense that merits the joint purchase and maintenance by several hospitals of effective incinerators. In addition, to minimize waste volume resulting from disposables, hospitals should expand their use of disposables "only after careful study and consultation with experts."

4-036
Lord, S.S. Your hospital is a polluter. Bulletin of the American Protestant Hospital Association, 35:16, Spring 1971.

This brief article reports an address to the Kentucky Hospital Association by S.S.Lord, Ph.D. accusing hospitals of frequently being the worst polluters in the community, generating varied and voluminous wastes. Rather than assuming immunity from ordinance regulations, hospitals should be models of proper waste disposal.

4-037
Marybelle, Sr. Waste handling and pest control. Executive Housekeeper, 14:18+, July 1967.

Because improperly collected and stored trash can provide harborage and breeding places for insects and rodents, proper handling and disposal of hospital solid waste is a prime control measure against pests. Hospitals generate nine specified types of waste which may be handled by a variety of waste disposal methods as dictated by local regulations and the hospital's facilities. On-site incineration is particularly advantageous because it eliminates pest harborage, lowers transfer costs, and contains dangerous wastes within the hospital. The housekeeper should consider the equipment used for waste collection, including receptables and liners, as well as protective clothing for housekeeping personnel. To familiarize the housekeeper with common hospital pests, their habits, and prevention and control methods, the author includes a detailed chart listing common insect pests and control methods.

4-038
Maurer, A.H. Solid waste disposal systems for hospitals. Progressive Architecture, 51:80, Dec. 1970.

This article broadly surveys the solid waste problem hospitals are facing today, discussing waste composition and quantity, then introducing different waste handling systems and offering guidance in choosing the "right system". Selection must be based on variables unique to each institution, as well as the specific advantages and disadvantages of each method. Furthermore, incorporating a system into an existing hospital demands criteria different from construction in a new institution.

4-039
Michaelsen, G.S.,and D. Vesley. Disposable hospital supplies: some administrative and technical implications. Hosptial Management, 101(1):23-28, Jan. 1966. [1303, Hospital Abstracts, 6(8), 1966].

This paper describes the results of a survey designed to provide information on the use of disposables from a cross section of 12 hospitals. After preliminary visits to the hospitals, which ranged in size from 121 to 850 beds, questionnaires were prepared which were then completed during a second visit and in most cases the administrator and other staff involved were interviewed. Questions asked were as follows: (i) what are the major administrative considerations influencing the decision to use or not to use the disposables; (ii) general cost of disposables in comparison with re-usables; (iii) how have staff accepted the disposables; (iv) have any disposables been discontinued and if so why; and (v) future plans as to increased or decreased use of disposables. Disposables were tabulated in the following hospital areas: (i) catering; (ii) nursing; (iii) surgical and obstetrical; (iv) laboratory; and (v) housekeeping. Records were examined for three-month periods and the data summarized is given in five tables which are included. Improved patient care seemed to be the main reason for using disposables; cost was generally found to be higher but methods of cost analysis vary which makes this difficult to calculate. The improving quality of disposables has in most cases led to their acceptance. Not many disposables once used had been discontinued and most hospitals felt that the use of disposables was increasing. Storage problems have been encountered and solved in many cases by more frequent deliveries as transport did not appear a problem. Puncture wounds had resulted from the disposal of needles and in some cases needles and syringes had been taken by children and drug addicts.

4-040
Montreal General Hospital recycles refuse to fight pollution. Canadian Hospital (Toronto), 49(1):13, Jan. 1972.

Montreal General Hospital initiated a two-phase anti-litter program to recycle its used newspapers and bottles for industrial plants, reducing the hospital's weekly three-ton waste volume by nearly 20 per cent.

4-041
Mood, E.W. Characteristics of solid waste from hospitals. Executive Housekeeper, 18:20+, Apr. 1971.

Hospitals face increasingly complex questions of how to collect, store, process, and dispose of solid waste, which doubled in quantity between 1955 and 1966, primarily due to single-use items. An American Public Health Association study of hospital solid waste concluded that the key to successful resolution of solid waste handling and disposal problems is consideration of these problems during the earliest stages of a hospital's design and planning. The committee recommended "use of disposable can liners, routine cleaning of all waste containers, mechanization of waste container washing facilities, and minimization of waste transfer operations". The author details his 1966 study of hospital solid waste quantities and handling, noting that solid waste procedures are affecced by the number and types of receptacles used for different types of waste. Handling methods are influenced by the ultimate disposal method, whether on-site or off-site, although on-site incineration achieves better separation of wastes and reduces scavenging. The author also discusses the quality of custodial employees and their injury rates.

4-042
Morrison, R.P., and V.R. Oviatt. Environmental control programs in health care facilities. Hospital Progress, 52(8):96-98+, Aug. 1971.

The hospital environment traditionally has escaped public scrutiny, even today when public fervor has marked this the "Age of the Environment". The authors suggest that an institutional environmentalist be authorized as part of the administrator's office and also serve as an "ex officio" member of any committee or "deliverative body which may consider environmental problems". Different approaches to environmental control can be applied to five general areas: radiological health; occupational health, accidental injury prevention; infections control; and general environmental hygiene. The authors discuss the organization of and approaches to environmental control programs in these areas, suggesting surveillance programs, educational support of personnel and patients, and the appointment of a policy formulating committee as supplementary measures for an effective program.

4-043
Mossman, S.A. An Analysis of Institutional Solid Wastes Systems. Urbana, University of Illinois, Jan. 1970. 61 p. [8508, SWIRS].

Present institutional solid waste systems are evaluated and the design of proposed systems is discussed. The University of Illinois is studied to provide an example of an institutional solid waste system. The quantity and composition of refuse produced is tabulated. The collection and disposal system consists primarily of removal of truck-mountable storage containers for transport to a transfer and compaction station and then to a sanitary landfill. Total collection and disposal costs amount to $4.48/ton. Reclamation or salvage methods are particularly favorable for institutional solid waste systems due to the relative homogeneity of waste materials from individual waste sources. Recommendations for improvement of present undesirable conditions at the University include: a combined disposal system for the cities of Champaign and Urbana and the University; continued use of sanitary landfill as the disposal method; salvage of mixed paper; use of gravity-type chutes within buildings and vacuum-tube transport between buildings; construction of a transfer station if a distance disposal site is used; and the establishment of one administrative unit to take responsibility for waste management.

4-044
New Jersey issues strict air pollution code. Hospitals, 42(16):164, Aug. 16, 1968.

New Jersey's air pollution code is strict and thorough, placing the responsibility on the incinerator operator. The code, effective August 15, 1968, specifies types of incinerators permitted and sets performance standards affecting old, as well as all new, incinerator construction. After two years, only multi-chamber or otherwise approved incinerators will be permitted; flue-fed units are banned. Single chamber incinerators allow material to escape up stacks, whereas multi-chamber incinerators prevent particle escape. Standards specify that small common incinerators may not emit more than .2 grains of particles/cu.ft. and large incinerators only 1. grain. Other requirements limit smoke density to not more than No. 1 on the Ringelmann Chart, and no particles can be large enough to be seen by the naked eye.

4-045
Organization for the Handling of Supplies and Materials - Vernon Jubilee Hospital. Victoria, British Columbia Hospital Insurance Service, 1968. 65 p. [MN2036, Abstracts of Hospital Management Studies, Vol. VI, 1970].

Detailed and comprehensive engineering study of materials handling, including purchasing, delivery, inventory, transfer internally. Laundry CSR and drug deliveries are covered, as is waste removal. Dietary delivery to patients is excluded. Extensive charts and task descriptions.

4-046
Pittsburgh hospitals participate in recycling project. Modern Hospital, 119(6):48, Dec. 1972.

In a pilot project initiated by the county health department, two Pittsburgh hospitals are separating glass and metal from other waste and selling them to glass and metal plants. One of the hospitals generates about 4000 intravenous bottles yielding about 1000 pounds of glass a month. The hospital receives $10 a ton for glass and $20 a ton for metal, which covers the cost of hauling. Although the process of cleaning the metal and glass is time consuming, "Personnel are eager to help with the solid waste problem".

4-047

Printup, R.H. Safety tips--housekeeping, supplies and equipment. Executive Housekeeper, 18(11):17-18+, Dec. 1971.

As part of this article the author offers tips for the safe and sanitary disposal of hospital waste. Empty aerosol cans should never be thrown in with burnable trash because of the possibility of injury to the operator and damage to the incinerator if the can should explode. Hands should never be used to pack down trash in a waste receptacle because of the danger of cuts and punctures from broken glass or exposed needles. "Pretend that every trash bucket is full of razor blades." Separation of burnables and nonburnables is encouraged, and all infectious wastes should be incinerated. Pills, capsules, liquids and similar materials should be disposed of in the sewerage system, and disposable needles and syringes should be bent or crushed to prevent further use. Wastes should be placed in impervious bags and stored in metal containers in a walled enclosure to exclude rodent and unauthorized persons.

4-048

Rees, S.A.H. Getting value for waste. Hospital and Social Service Journal (London), 62:590, May 30, 1952.

Waste can be categorized as productive or nonproductive, the former having a monetary value. Productive waste includes food, textiles, and iron, but the values of all forms of waste have continued to rise. Hospital wastes can command high prices. Rags, especially woolens, have value, and the value of scrap metals, especially lead and copper, is high. Silver nitrate can be recovered from used X-ray films which are valuable to plastic manufacturers. Paper prices fluctuate greatly, but a baling machine could reduce handling difficulties. Additional value exists in old vehicles, obsolete equipment, and miscellaneous items.

4-049

Ryckman, D.W. and G.M. Barsom. Pollution control engineering in hospitals. Hospital Progress, 52(2):58-63, Feb. 1971. [13663, SWIRS].

Although solid waste disposal has taken a large amount of publicity, and although articles on solid waste disposal abound, hospital management has not been keeping pace. Few papers have been written on hospital waste and little is actually known statistically about the problem. In order to find a solution, general considerations about the sources of hospital waste and its classes must be examined. After identification, the hospital can go on to combat the situation. For example, air pollution not only includes what the hospital's incinerator emits, but also what pollution finds its way into the hospital from the outside. Another case is water pollution that emits from hospitals, due to the disposal of medicines and radioactive materials. Mainly, solid waste disposal should be analyzed and a thorough understanding of the incineration or landfill or shredding techniques should be had. Finally, an institutional pollution audit should be taken, the steps of such an audit being outlined in the test.

4-050
Sleight, R.E. Systems analysis smoothes conversion to disposables. Hospitals, 41(21):84+, Nov. 1, 1967. [1214, Hospital Abstracts, 8(8), 1968].

The 750-bed Grady Memorial Hopsital, Atlanta, set up in March 1964 an enquiry into the advantages and feasibility of changing over to the use of disposables. The study was made jointly by the hospital and an independent agency. It was found that a complete change-over to disposables could be more practical than a gradual process of displacing re-usable items with disposables. Economically, the full use of disposables would effect an "out-of-pocket" saving of $21,338 for the hospital. It was also decided to improve the waste disposal system by using disposable plastic linings to waste receptacles: this would save over $5,000 a year. Full details are given of the study and of the procedures recommended for adoption. The paper is illustrated with five photographs, a chart and a table.

4-051
Smith, R.J. Bacteriological Examination of Institutional Solid Wastes. M.S. Thesis. West Virginia University, Morgantown, W.Va., 1970. 53 p. [12139, SWIRS].

The increased production of solid waste in the past has led to a rising problem in the possibility of contamination of persons from pathogenic microorganisms in the refuse. A bacteriological examination was made of solid wastes generated in the University Medican Center of Morgantown, West Virginia. Each sample was checked for: total count, total anaerobic count, aerobic sporeformers, anaerobic sporeformers, coliform count, pathogenic Staphlococci, beta-helolytic organisms, fungi, Streptococci and Enterococci. In the beginning of the study, all samples were taken from the incinerator room in the basement of the University Hospital. In the latter part of the study, sampling began on a total hospital basis to verify the assumption that refuse from the administrative offices was of low microbial count. All plastic was sorted from the refuse, which was then ground on a large Wisconsin grinder. All samples were analyzed under aseptic conditions, diluted and inoculated on agar plates and broths. The colonies were counted and a computation was made of the number of organisms/g of refuse. It was concluded that Bacillus organisms made up 80 to 90 percent of the population. Streptococcus organisms comprised 5 to 10 percent of the population. Mannitol Salt Agar was not selective enough for Staphylococcus organisms, and Bacillus grew too well. It is recommended that a complete bacteriological analysis be made of the University Hospital and statistical analyses be established/ hospital station.

4-052
Speers, R., Jr. and R.A. Shooter. Shedding of bacteria to the air from contaminated towels in paper sacks. Lancet (London), 2:301-302, 1967.

Towels contaminated with *Sarcina lutea* were placed in either polythene lined sacks or unlined paper sacks; left unsealed, loosely sealed, or tightly sealed with sellotape or staples; and then left stationary or subjected to movement activity. Sampling the room air for the tracer organism demonstrated the need for tightly sealing the sacks, preferably using lined sacks.

4-053
Syska & Hennessy, Inc. Hospital systems: part iv: solid waste disposal. Technical Letter, 19(2):1-4, Sept. 1969.

Automated waste collection and transportation systems to replace manual in-hospital collection frequently combine the four main steps in solid waste disposal: collection, transportation, processing, and removal. Moreover, such systems can reduce a hospital's annual operating costs while maintaining sanitary conditions and handling the rapidly increasing waste volumes. After discussing automated systems of internal collection and transport, six methods of final processing and disposal are discussed: disposal without processing; pulping; compacting; chopping and low ratio compacting; chopping and high ratio compacting; and chopping, pulping and incineration. Because choosing the right system depends on many factors unique to each hospital, selection should be done in consultation with professional engineers.

4-054
Syska & Hennessy, Inc., Engineers. Solid Waste Handling Systems for Navy Hospitals. New York, Syska & Hennessy, Inc., Engineers, Feb. 1972. 103 p.

The report details the advantages, disadvantages and costs of various collection, processing and disposal methods. The recommendations include the use of a pneumatic tube system for waste collection and transportation to a central point; color coded plastic bags to aid in the separation of infectious or hazardous waste; food waste grinders if local sewage treatment plants will permit, or pulpers for food wastes if grinders cannot be used; and incineration or compaction of the waste. "Local codes and attitudes, individual hospital policies, physical arrangements, and economics are determining factors as to which system [incineration or compaction] should be used".

4-055
Trigg, J.A. Microbial Examination of Hospital Solid Wastes. M.S. Thesis. University of West Virginia, Morgantown, W.Va., 1971. 55 p. [Abstracts, Excerpts and Reviews, Vol. V., 1972].

The thesis deals with the potential health hazards associated with contaminated solid wastes generated in a large teaching hospital. It includes a detailed explanation of analysis materials and procedures for the determination of the microbial counts in the refuse. The data are an indication as to the types of microorganisms most commonly associated with hospital refuse. The data also furnish evidence as to which types of stations would be more likely to generate the most potentially pathogenic solid wastes. The author found that pathogenic bacteria can be present in hospital refuse in significantly high concentrations, and especially so, if an organic substrate is present. Coliform counts ranged from less than 1 per gram of refuse at some stations to as high as 8.6/gram at one station. The range of fecal streptococcus was from less than 1/gram to as high as 8.0/gram; that of staphylococcus, from less than 2/gram to 7.1/gram; Candida albicans from less than 2/gram to 3.8/gram; Pseudomonas spp., from less than 2/gram to 8.4/gram; and spore counts, from less than 1.5 to 3.9/gram. The additional time between collection and incineration may allow continued multiplication and hence lead to higher counts. Certain types of bacteria were more prevalent in the refuse of some stations than in others. The difference is probably a function of source and type of waste generated. Staphylococcus aureus was by far the most predominant pathogen in the refuse. True numbers of the organism could not be obtained because the overwhelming growth of S. epidermidis on the selective agar plates. Refuse containing the highest coliform counts would be the most likely to generate enteric pathogens. Spore-forming organisms were not present in sufficient numbers to constitute a potential hazard if accepted methods of sterilization were followed. The substantial ratio of bacteria of human origin to those of nonhuman origin suggests the undetected presence of the more virulent pathogenic viruses and bacteria. The researcher feels that an extensive air sampling program should be undertaken to assess the magnitude of potential hazard of the S. aureus problem.

4-056
Wheeler, E.T. No hospital is an island. Hospitals, 46(20):113-116+, Oct. 16, 1972.

Because the environmental design of hospitals must include both internal and external considerations, "the planner's task...is to reconcile the design requirements into a workable combination of land, buildings, and equipment that will recognize all ties with the community while meeting the technical requirements for health care within the hospital." Problems which affect both the hospital and the community are: the quantity and quality of water yield in the hospital; the quality and quantity of air used in the hospital; the disposal of diverse human wastes; the use of paper, cloth, and other decomposable items; the disposal of all plastics and other materials not subject to natural decomposition; the control of harmful radiation; the use of all metals; the use of electrical power; and transportation and communication. These problems must be approached in terms of both traditional goals and those arising from today's recognition of finite resources. To do this, the author calls for both general and ecological criteria for institutional designers.

4-057
Williams, E.R. Naval hospital. Garbage and rubbish. In Refuse Collection and Disposal at U.S. Naval Installations, Guam, Mariana Islands. San Francisco, U.S. Public Health Service, 1958. p. 27-35. [7653, SWIRS].

The Naval Hospital operates a refuse collection and disposal system which services the hospital and the housing units on the hospital reservation. Total population served, including patients, is about 600 persons. The maintenance officer is directly responsible for this operation. Regulations and instructions pertaining to refuse collection and disposal by the Naval Hospital are given. Adequate regulations on refuse collection and disposal are in effect at the Naval Hospital. Refuse quantities produced at the Naval Hospital are much higher per capita than normally produced in the United States. Storage and collection of all refuse by the Naval Hospital meet or exceed the best accepted practice of U.S. cities. It is recommended that disposal of Naval Hospital refuse at the Toto dump be discontinued. Refuse from the Naval Hospital should be disposed of at the Naval Air Station Agana dump or at the Cabras Island dump.

4-058
Wilson, D.G. Institutional solid waste management. Executive Housekeeper, 17(9):26+, Oct. 1970.

Buildings of the future might find a completely automated materials handling system, particularly for solid waste, a desirable feature. Solid waste poses unique problems with insects, fire, and odor. The use of disposables is increasing the volume of solid waste in the hospital, and hazardous wastes require special handling and disposal. The article discusses traditional and newer methods of handling solid wastes including pneumatic and hydraulic systems, containers, compactors, balers, shredders, and incinerators, in addition to exploring the possibilities of recycling and reclamation.

4-059
Zimmerman, B.W. The Hospital's Role in Environmental Protection.
M.H.A. Thesis. Duke University, Durham, North Carolina, 1972. 57 p.
[08733HU, Abstracts of Hospital Management Studies, Vol. IX-3, 1973].

Author analyzes hospital's role in environmental protection from three aspects: nature of the hospital pollution problem; legal implications of pollution originating in hospitals; and methods by which hospitals might approach the problem of environmental pollution. Data were taken from available literature and testimony before Senate Sub-committee on Air and Water Pollution. It was found the primary environmental problem faced by hospitals is solid waste disposal, due largely to the proliferation of disposal items used in the hospital. Study found litigation against hospitals for pollution can be expected in the future. It is suggested an inclusion of an environmental protection function in the hospital organization would aid in tempering the proliferation of disposables, provide information on pollution control codes and investigate the possibilities of recycling.

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